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REPORT ON THE ANALYSIS OF THE QUALITY ASSURANCE AND QUALITY CONTROL DATA FOR THE PETROLEUM REFINING SECTOR

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REPORT ON THE ANALYSIS OF THE QUALITY ASSURANCE AND QUALITY CONTROL DATA FOR THE PETROLEUM REFINING SECTOR

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INTRODUCTION

The Municipal/ Industrial Strategy for Abatement (MISA) program is a regulatory program with the ultimate goal of virtual elimination of persistent toxic contaminants from all discharges to Ontario waterways.

The MISA Effluent Monitoring Regulations have been promulgated for nine industrial sectors, first of which was the petroleum refining sector. The Effluent Monitoring Regulations required direct dischargers to monitor their effluents for a specified number of contaminants and a specified frequency over a period of one year.

This report is an assessment of the Quality Assurance/Quality Control (QA/QC) data for the petroleum refining sector. The QA/QC assessment process was used to evaluate the suitability of the effluent monitoring data for use in the effluent limit setting process.

1.0 - BACKGROUND

The petroleum refining sector in Ontario consists of seven refineries. Six of them are typical refineries and one is mainly a petrochemicals feedstock plant (Novacor).

The Effluent Monitoring Regulation for the MISA Petroleum Refining Sector was promulgated in June 1988, as Ontario Regulation 359/88. The monitoring started December 1, 1988 and ended November 30, 1989.

Ontario's petroleum refineries monitored their effluents for 149 parameters under strict protocols according to Ministry specifications. In addition to sampling and flow monitoring, the refineries were required to carry out a quality control program on all process effluent streams and for specified analytical test groups.

The results of monitoring were published in two preliminary reports. The first six months of monitoring data report was issued in December 1989 and the second six month report was issued in July 1990. The reports were preliminary since at that time QA/QC assessment of data was not done.

The two types of QA/QC data were required under the regulation: field QA/QC, which would indicate any problems with sampling or field contamination, and laboratory QA/QC, which would indicate problems with the laboratory (analytical procedures, laboratory contamination, etc).

The field QA/QC data included analyses of travelling blanks, travelling spiked blanks, and duplicate samples for specified analytes, collected at the process effluent stream, and at specified frequencies.

The laboratory's QA/QC data included method blanks, spiked method blanks, spiked samples, and replicate samples analyses. The refineries were not obliged to report laboratory QA/QC data but they were required to retain the results of certain laboratory QC checks (as specified in the MISA regulation) for possible audit/review by the Ministry.

1.1 - FIELD QA/QC

A short description of field QA/QC samples and reasons for collecting QA/QC data are given below.

Travelling Blanks

A travelling blank is a sample of uncontaminated (distilled) water that accompanies a set of sample containers from the laboratory to a sampling point where it is opened, preserved, resealed and returned to the laboratory with a set of samples for analyses.

Analysis of the travelling blank sample will indicate field contamination, if present, or laboratory analytical problems. Comparison with the method blank sample will indicate the relative importance of field versus laboratory sources of contamination.

Travelling Spiked Blanks

A travelling spiked blank is a sample of uncontaminated water to which a known quantity of the target parameters have been added by the laboratory in the 24 hour period preceding travel. This sample accompanies sample containers from the laboratory to the sampling site but it is not opened at the site.

Analysis of travelling spiked blank data will indicate whether the recovery of parameters is influenced by transport and storage time of the sample. It serves to evaluate the level of recovery in order to establish if the effluent data is biased (low/high), determine the effect on data variability, evaluate the risk of under-estimates, and false negatives. Over-recovery may serve to confirm contamination.

Duplicate Samples

A duplicate sample is one of the two samples collected at the same sampling point at the same time in a manner that minimizes differences between the samples. Duplicate sample analysis provides for the evaluation of sampling and analysis variability. It can also be used to confirm the reality of day to day effluent data variability.

1.2 - LABORATORY QA/QC

Method Blank

A method blank is an uncontaminated sample of distilled water processed through an entire analytical procedure. Method blank data may be erratic due to laboratory environment contamination (background levels). It is normally used to determine the need and validity of corrections for labware/reagent contamination, but corrections should be evaluated and controlled. Failure to correct properly may lead to false positive decisions (lack of correction) or false negative decisions (over correction). Method blank is compared to travelling blank to establish the difference between field and laboratory contamination.

Spiked Method Blank

A spiked method blank is a method blank sample to which a known quantity of standard solution is added. The analysis of spiked method blank and method blank are performed on a daily basis to ensure adequate calibration of the measurement system.

Spiked Sample

A spiked sample is an effluent sample to which a known quantity of standard solution is added. It serves to evaluate matrix interferences which are common in many tests.

Replicate sample

A replicate sample is an effluent sample and is one of at least two aliquots removed from a single sample. This sample provides a measure of analytical precision within an analytical run. Difference between paired results provides an estimate of laboratory precision. Outliers will suggest laboratory contamination or sample non-homogeneity.

2.0 - PURPOSE OF QA/QC ANALYSIS OF MONITORING DATA

The purpose for collecting QA/QC data was to evaluate the quality and validity of the data submitted. The primary concern is not with the quality of individual values, but rather with the general validity of the total set of data.

The objectives of the QA/QC analysis are:

a) To identify the significance of:

  - biases
  - chronic contamination
  - data variability
  - false results (either negative or positive)
  - field sampling or laboratory analytical problems

b) To assess the validity of data reported in the Effluent Monitoring database.

c) To allow comparability of data among the companies in the sector and the laboratories performing the analysis.

3.0 - THE QA/QC ASSESSMENT PROCESS

The QA/QC assessment process used in evaluating the effluent monitoring data for the Ontario petroleum refineries followed the general approach outlined in the MISA Issues Resolution Process - Issue Resolution Committee Reports (MOE 1990). The general approach consists of the following:

Step 1. The retrieval and screening of all the field QA/QC data (travelling blanks, travelling spiked blanks, duplicates, and corrected and uncorrected process effluent data) for a particular plant, and all effluent data for each process stream at that plant.

Step 2. The sorting and summarizing of the QA/QC and effluent monitoring data.

Step 3. Evaluation of the QA/QC and effluent monitoring data.

In the evaluation of the QA/QC data emphasis was placed on those parameters identified as candidates for limits. The remaining parameters were investigated for possible false negative results.

3.1 - SELECTION OF CANDIDATE PARAMETERS

To select the potential candidates for limits the "90/10 rule" was applied to the 1989 MISA monitoring data. Parameters were deleted from the data set if the effluent monitoring data showed (at a 95% confidence level) that 90% of the data were at concentrations lower than the Regulation Method Detection Limit (RMDL).

3.2 - RETRIEVAL AND SCREENING OF FIELD DATA

All analytical results with remark codes ">", "A", "<DL", "<T" and "<W", and analytical results without a remark code were included in the retrieval of data (see Appendix A for list of remark codes). All data with remark codes different than the ones mentioned above were excluded because they represent questionable results (approximately 1.5% of the database).

Data with analytical results below the RMDL were used as reported unless the value was less than or equal to RMDL/10 (see Appendix B for list of RMDLs). In this case, the value of RMDL/10 was substituted. It should be noted that when a parameter level is reported as less than the detection limit (i.e. remark code "<DL")[*] it means that the laboratory did not report the measurement level. The measured level could be anywhere between zero and the detection limit. In the petroleum refining sector database,

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[*] DL refers to the LMDL (Laboratory Method Detection Limit)

approximately 40% of process effluent data were reported with the "<DL" remark code.

Appendix C contains QA/QC summary tables for all refineries:

Table 1	Preliminary List of Candidate Parameters
Table 2	Average Process Effluent Concentration Ratio and Occurrence Classification for Candidate Parameters Monitored Daily and Thrice-Weekly.
Table 3	Average Process Effluent Concentration Ratio and Occurrence Classification For Candidate Parameters Monitored Quarterly and in Characterization.
Table 4	Average Process Effluent Travelling Blank Concentration Ratio for Candidate Parameters
Table 5	Average Absolute Difference Concentration Ratio between Process and Duplicate Data for Candidate Parameters

Appendix D contains QA/QC output tables for each refinery. There are six sets of tables in the Appendix D, and each set represents information about a particular group of data, as follows:

1.1 - 1.7	Detection Frequencies and Concentration Ratios for Candidate Parameters Monitored Daily and Thrice-Weekly in Process Effluent
2.1 - 2.7	Detection Frequencies and Concentration Ratios for Candidate Parameters Monitored Quarterly and Semi-Annually in Process Effluent
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3.3 - SORTING AND SUMMARIZING

Sorting by Frequency of Occurrence

All candidate parameters were sorted according to their frequency of occurrence above the RMDL. After analyzing the results from the sorting exercise, it was concluded that the parameters could be grouped into three main categories for all of the seven refineries:

Frequent Occurrence: Frequency of occurrence above the RMDL is greater than 40%

Infrequent Occurrence: For frequently monitored parameters (daily and thrice-weekly), frequency of occurrence above the RMDL is between 1% and 40%.

For the infrequently monitored parameters (quarterly), frequency of occurrence above the RMDL is between 10% and 40%.

Non-occurrence: Less than 1% of observations are above the RMDL - if the parameter was monitored daily and thrice-weekly.

Less than 10% of observations are above the RMDL - if the parameter was monitored quarterly (for example, one detection in 12 observations would result in non-occurrence).

Sorting by Level of Analyte

In order to quantify the importance of detection of a certain parameter and to be able to compare data for different parameters, a **"concentration ratio"** was introduced. Concentration ratio represents average concentration of a parameter divided by a respective RMDL. A concentration ratio of 1.0 would indicate that the reported result for that parameter was equal to the RMDL.

In order to summarize and sort the effluent data according to the above-noted categories, the process effluent data (concentration ratios) for each parameter in each refinery were compared to 5 x RMDL, 2 x RMDL and the RMDL.

Within both the "frequent occurrence" or "infrequent occurrence" categories, parameters were further classified, according to the levels of analytes, into three sub-categories:

- **High Level** - used to describe quantitative data
- **Medium Level** - used to describe semi-quantitative data
- **Low Level** - used to describe qualitative data

The following criteria were used for these 3 sub-categories:

Frequent Occurrence

High Level:	50% or more of the observations have concentration ratio greater than 5 x RMDL
Medium Level:	At least 50% of the observations have concentration ratio greater than 2 x RMDL
Low Level:	At least 40% of the observations have the concentration ratio above the RMDL.

Infrequent Occurrence

High Level:	Of those observations that are greater than 2 x RMDL, more than 50% are higher than 5 x RMDL.
Medium Level:	Of those observations higher than the RMDL, more than 50% are higher than 2 x RMDL.
Low Level:	All the observations which do not fit the criteria listed for infrequent occurrence at either the high or medium level of analytes.

Taking in account both frequency of occurrence and level of analyte further classification of parameters could be done into the following sub-categories:

Frequent Occurrence - High Level (FH):

More than 50% of the observations are above 5 x RMDL.

Frequent Occurrence - Medium Level (FM):

More than 50% of the observations are above 2 x RMDL.

Frequent Occurrence - Low Level (FL):

More than 40% of the observations are above the RMDL.

Infrequent Occurrence - High Level (IH):

Of those observations that are greater than 2 x RMDL, more than 50% of values (concentration ratios) are greater than 5 x RMDL.

Infrequent Occurrence - Medium Level (IM):

Of those observations that are above the RMDL, more than 50% of values are greater than 2 x RMDL.

Infrequent Occurrence - Low Level (IL):

Observations do not fit the criteria listed for infrequent occurrence at either the high or medium level.

Each of the sub-categories was then evaluated through analysis of travelling blank results, duplicate sample results, and travelling spiked blank results for the following items:

Frequent High : Check accuracy, recovery, precision

Frequent Medium : Check for blank biases, recovery, precision

Frequent Low : Check for false positives, recovery

Infrequent High : Check for contamination, process changes (if several parameters in a single sample are at elevated levels)

Infrequent Medium : Check for blank biases, recovery

Infrequent Low : Check for false positives, false negatives

Tables 2 and 3 (in Appendix C) summarize the results of this classification for all seven refineries.

Table 2 shows the concentration ratios and occurrence classification for frequently monitored parameters (daily and thrice-weekly) for all seven refineries.

Table 3 shows the concentration ratios and occurrence classification for infrequently monitored parameters (quarterly and semi-annually) for all seven refineries.

Table 4 (Appendix C) summarizes average travelling blank concentrations ratios (i.e. average travelling blank concentration divided by the RMDL) for parameters examined in each refinery. Travelling blank concentration ratios which are less than 1.0 indicate that the effluent data for that parameter are satisfactory.

Table 5 (Appendix C) shows the ratio of the absolute difference between effluent data and corresponding duplicate data to the RMDL. The information presented in Table 5 was used to evaluate the precision with which field duplicate results could be reproduced, i.e. the lower the ratio the better precision.

The recoveries of the travelling spiked blanks and spiked quantities are summarized in tables 4.1 to 4.7 in the Appendix D. In general, recoveries greater than 40% and less than 140% in travelling spiked blanks were considered satisfactory. Recoveries of less than 40% were of concern and suspect of false negative conclusion or under-estimates. Recoveries of greater than 140% were examined for either data entry errors or laboratory contamination by checking method blanks.

3.4 - EVALUATION OF QA/QC DATA

QA/QC data evaluation was carried out using appropriate strategies which were established in the QA/QC IRC report (MOE 1990).

Evaluation of Frequent Occurrence Parameters

STRATEGIES:

Assess the likelihood of over-estimation or under-estimation based on the recovery of travelling spiked blanks.

Assess the possibility of error in blank corrections (evaluate corrected versus uncorrected).

Assess precision using field duplicates and, if necessary, using laboratory replicates.

Evaluation of Infrequent Occurrence Parameters

STRATEGIES:

Determine the possibility of false negative conclusions based on a possible under recovery of travelling spiked blanks.

Determine the possibility of false positive conclusions based on possible chronic contamination of travelling blanks.

Determine the possibility of under-correction or over-correction for laboratory method blanks.

The candidate parameters identified as occurring infrequently were mostly metals and organics. When the QA/QC data were analyzed for these parameters, consideration was also given to the following aspects:

Unique parameters - found in one refinery only

- anomalies in refinery process operation
- special chemicals used at that site
- possibility of field contamination
- possibility of laboratory contamination

Parameters found at limited number of refineries

- use of same contract laboratory
- possibility of laboratory contamination

- similarity of processes or chemicals used

Frequency of occurrence related to a quarter in which samples were analyzed

- occurrence in only one quarter (investigate for process upsets and occurrence of other parameters at the time of sampling)
- detection resulting from process change or a spill.

Evaluation of Non-Occurrence Parameters

STRATEGIES:

Determine the possibility of false negative conclusions based on the possible under-recovery of travelling spiked blanks.

Determine the possibility of over-correction for laboratory method blanks.

Non-Candidate Parameters

All the non-candidate parameters were also checked for false negative results by examining the recovery levels of the travelling spiked blanks to check for under-recovery. Corrected and uncorrected data for method blank were also examined to check for possible over-correction.

4.0 - RESULTS OF THE QA/QC ASSESSMENT

4.1 - SELECTION OF CANDIDATE PARAMETERS

After applying the "90/10 rule" for selection of candidate parameters, a total of 53 parameters qualified as potential candidates for limits (Table 1 in Appendix C).

Non-Detected Candidate Parameters

Under the requirements of the MISA monitoring regulation, the laboratories which performed the analysis had to meet certain requirements regarding the analytical detection limit. The Laboratory Method Detection Limit (LMDL) had to be equal to, or lower than the RMDL. When the presence of a parameter could not be detected (non measurable at the LMDL), the result of analysis was reported as the LMDL value prefixed by the symbol "<" and accompanied by a remark code "<DL", meaning that a parameter was not "found" at the detection limit.

A detailed review of the monitoring data for the 53 parameters revealed that 19 of them were selected as candidate parameters because their LMDL values were greater than their respective RMDL values. The analytical results for these parameters were consistently reported with the remark code "<DL", meaning that they were not really "found".

Since the presence or absence of these parameters is uncertain they were eliminated from further consideration[**]. The list of the 19 parameters which were not actually "found", is presented in Table 4.1.

[**] All the tables in the Appendices include data for these 19 parameters

TABLE 4.1 - Non-Detected Candidate Parameters

ATG	PARAMETER
9	Cadmium
16	Bromomethane
19	Naphthalene
	Pyrene
20	2,3,4,5-Tetrachlorophenol
	2,3,4-Trichlorophenol
	Pentachlorophenol
23	1,2,3-Trichlorobenzene
24	2,3,7,8-TCDD
	Octachlorodibenzo-p-dioxin
	Octachlorodibenzofuran
	Total H6CDD
	Total H6CDF
	Total H7CDD
	Total H7CDF
	Total PCDD
	Total PCDF
	Total TCDD
	Total TCDF

4.2 - EVALUATION OF CANDIDATE PARAMETERS

Of the remaining 34 preliminary candidate parameters eighteen were categorized as "frequent occurrence" and sixteen as "infrequent occurrence".

Frequent Occurrence Parameters

The 18 frequently occurring parameters were found to be present in process effluents from all, or almost all, of the Ontario petroleum refineries. These 18 parameters are conventional and non-conventional contaminants: chemical oxygen demand (COD), cyanide, pH, ammonia and ammonium, total Kjeldahl nitrogen (TKN), nitrate plus nitrite, dissolved organic carbon (DOC), total organic carbon (TOC), total phosphorus, specific conductance, total suspended solids (TSS), volatile suspended solids (VSS), aluminum, zinc, arsenic, phenolics (4AAP), sulphide, and oil and grease. The evaluation of QA/QC data for these parameters confirmed their presence in the process effluents at the levels observed.

Infrequent Occurrence Parameters

A summary of the detailed QA/QC Assessment of each parameter in the "infrequent occurrence" category is presented in the Appendix E in order of Analytical Test Group (ATG).

The evaluation of QA/QC data for the 16 infrequently occurring parameters resulted in rejection of all 16 as candidates for limits for the following reasons:

- Methylene chloride - its presence was the result of laboratory contamination
- 1,2-Dichloroethane and chloroform - due to insufficient data
- Chromium - high variability of data
- Molybdenum, selenium and mercury - very low results
- Toluene and o-xylene - suspect of both field and laboratory contamination
- Copper, vanadium, 1,2-dichloropropane, chloromethane, benzene, chromium (hexavalent) and m- & p-xylene - as "unique" parameters, i.e. found in one location only, very infrequently and at low concentrations (close to RMDL)

TABLE 4.2 - Parameters Removed Through QA/QC Evaluation

ATG	PARAMETER
9	Chromium
	Copper
	Molybdenum
	Vanadium
	Selenium
11	Chromium (hexavalent)
12	Mercury
16	1,2-Dichloroethane
	1,2-Dichloropropane
	Bromomethane
	Chloroform
	Chloromethane
	Methylene chloride
17	Benzene
	Toluene
	m-Xylene and p-Xylene
	o-Xylene

Non-Occurrence Parameters

The evaluation of QA/QC data for non-occurrence parameters confirmed their absence from the process effluents.

4.3 - EVALUATION OF NON-CANDIDATE PARAMETERS

The evaluation of QA/QC data for "non-candidate" parameters confirmed their absence from the process effluents.

5.0 - CONCLUSIONS

Of the 149 parameters monitored in the petroleum refining sector, 34 parameters qualified as candidates for limits.

The QA/QC evaluation of monitoring data for the 34 candidate parameters confirmed the presence of 18 parameters at such levels that they could be used to set statistically valid quantitative limits. These parameters are listed here in Table 5.1.

The 16 parameters which were categorized as "infrequent occurrence", were found at very low levels. The QA/QC evaluation of these parameters showed that the presence (reliability) of data at such low levels can not be confirmed. These data cannot be used to set statistically valid quantitative limits.

TABLE 5.1 - Final List of Candidate Parameters

ATG	PARAMETER
1	Chemical Oxygen Demand (COD)
2	Cyanide Total
3	Hydrogen ion (pH)
4a	Ammonia plus Ammonium
	Total Kjeldahl nitrogen
4b	Nitrate+Nitrite
5a	Dissolved Organic Carbon (DOC)
5b	Total Organic Carbon (TOC)
6	Total phosphorus
7	Specific conductance
8	Total Suspended Solids (TSS)
	Volatile Suspended Solids (VSS)
9	Aluminum
	Zinc
10	Arsenic
14	Phenolics (4AAP)
15	Sulphide
25	Oil and Grease

APPENDIX A

REMARK CODES

REMARK CODES

REMARK CODE (PREMK)	DESCRIPTION
<	Actual amount less than reported
>	Actual amount probably greater than reported
A	Approximate value
<DL	Reported value = MDL: measured amount < MDL (non-zero)
<T	A measurable trace amount: interpret with caution
<W	No measurable response (zero): reported value
<WE	No measurable response (diln/concn): reported value
AR	Attached report
I	Interference suspected
IC	Interference: colour
IM	Interference: Sample Matrix
N/A (OR !)	No data will be reported: see textual report
OLD	Old: sample exceeds maximum storage time
UQC	Data unreliable: possible lab QC problem(s)
!IN	No data: insufficient volume due to inspection
!NM	No effluent - no sample available
UCR	Data unreliable: could not confirm by reanalysis

APPENDIX B

REGULATION METHOD DETECTION LIMITS

ATG	PARAMETER	RMDL	RUNIT
1	COD	10.000	mg/L
2	Total Cyanide	.005	mg/L
3	Hydrogen ion (pH)	N/A	
4a	Ammonia plus Ammonium	.250	mg/L
	Total Kjeldahl nitrogen	.500	mg/L
4b	Nitrate+Nitrite	.250	mg/L
5a	DOC	.500	mg/L
5b	TOC	5.000	mg/L
6	Total phosphorus	.100	mg/L
7	Specific conductance	5.000	uS/cm
8	Total suspended solids	5.000	mg/L
	VSS	10.000	mg/L
9	Aluminum	30.000	μg/L
	Beryllium	10.000	μg/L
	Cadmium	2.000	μg/L
	Chromium	20.000	μg/L
	Cobalt	20.000	μg/L
	Copper	10.000	μg/L
	Lead	30.000	μg/L
	Molybdenum	20.000	μg/L
	Nickel	20.000	μg/L
	Silver	30.000	μg/L
	Thallium	30.000	μg/L
	Vanadium	30.000	μg/L
	Zinc	10.000	μg/L
10	Antimony	0.005	mg/L
	Arsenic	0.005	mg/L
	Selenium	0.005	mg/L
11	Chromium (Hexavalent)	0.010	mg/L
12	Mercury	.100	μg/L
13	Tetra-alkyl lead	.002	mg/L
	Tri-alkyl lead	.002	mg/L
14	Phenolics (4AAP)	0.002	mg/L
15	Sulphide	.020	mg/L
16	1,1,2,2-Tetrachloroethane	4.300	μg/L
	1,1,2-Trichloroethane	.600	μg/L
	1,1-Dichloroethane	.800	μg/L
	1,1-Dichloroethylene	2.800	μg/L
	1,2-Dichlorobenzene	1.400	μg/L
	1,2-Dichloroethane	.800	μg/L
	1,2-Dichloropropane	.900	μg/L
	1,3-Dichlorobenzene	1.100	μg/L
	1,4-Dichlorobenzene	1.700	μg/L
	Bromoform	3.700	μg/L
	Bromomethane	3.700	μg/L
	Carbon tetrachloride	1.300	μg/L
	Chlorobenzene	.700	μg/L
	Chloroform	.700	μg/L
	Chloromethane	3.700	μg/L
	Cis-1,3-Dichloropropylene	1.400	μg/L
	Dibromochloromethane	1.100	μg/L
	Ethylene dibromide	1.000	μg/L
	Methylene chloride	1.300	μg/L
	Tetrachloroethylene	1.100	μg/L
	Trans-1,2-Dichloroethylene	1.400	μg/L
	Trans-1,3-Dichloropropylene	1.400	μg/L
	Trichloroethylene	1.900	μg/L
	Trichlorofluoromethane	1.000	μg/L
	Vinyl chloride	4.000	μg/L

ATG	PARAMETER	RMDL	RUNIT
17	Benzene	.500	μg/L
	Ethylbenzene	.600	μg/L
	Styrene	.500	μg/L
	Toluene	.500	μg/L
	o-Xylene	.500	μg/L
	m-Xylene and p-Xylene	1.100	μg/L
18	Acrolein	4.0	μg/L
	Acrylonitrile	4.2	μg/L
19	Acenaphthene	1.300	μg/L
	5-nitro, Acenaphthene	4.300	μg/L
	Acenaphthylene	1.400	μg/L
	Anthracene	1.200	μg/L
	Benz(a)anthracene	.500	μg/L
	Benzo(a)pyrene	.600	μg/L
	Benzo(b)fluoranthene	.700	μg/L
	Benzo(g,h,i)perylene	.700	μg/L
	Benzo(k)fluoranthene	.700	μg/L
	Camphene	3.500	μg/L
	1-Chloronaphthalene	2.500	μg/L
	2-Chloronaphthalene	1.800	μg/L
	Chrysene	.300	μg/L
	Dibenz(a,h)anthracene	1.300	μg/L
	Fluoranthene	.400	μg/L
	Fluorene	1.700	μg/L
	Indeno(1,2,3-cd)pyrene	1.300	μg/L
	Indole	1.900	μg/L
	1-Methylnaphthalene	3.200	μg/L
	2-Methylnaphthalene	2.200	μg/L
	Naphthalene	1.600	μg/L
	Perylene	1.500	μg/L
	Phenanthrene	.400	μg/L
	Pyrene	.400	μg/L
	Benzylbutylphthalate	.600	μg/L
	Bis(2-ethylhexyl)phthalate	2.200	μg/L
	Di-n-butylphthalate	3.800	μg/L
	4-Bromophenyl phenyl ether	0.300	μg/L
	4-Chlorophenyl phenyl ether	0.900	μg/L
	Bis(2-chloroisopropyl)ether	2.200	μg/L
	Bis(2-chloroethyl)ether	4.400	μg/L
	2,4-Dinitrotoluene	0.800	μg/L
	2,6-Dinitrotoluene	0.700	μg/L
19	Bis(2-chloroethoxy)methane	3.500	μg/L
	Diphenylamine	14.000	μg/L
	N-Nitrosodiphenylamine	14.000	μg/L
	N-Nitrosodi-n-propylamine	3.100	μg/L
20	2,3,4,5-Tetrachlorophenol	.400	μg/L
	2,3,4,6-Tetrachlorophenol	2.800	μg/L
	2,3,5,6-Tetrachlorophenol	1.600	μg/L
	2,3,4-Trichlorophenol	.600	μg/L
	2,3,5-Trichlorophenol	1.300	μg/L
	2,4,5-Trichlorophenol	1.300	μg/L
	2,4,6-Trichlorophenol	1.300	μg/L
	2,4-Dimethylphenol	7.300	μg/L
	2,4-Dinitrophenol	42.000	μg/L
	2,4-Dichlorophenol	1.700	μg/L
	2,6-Dichlorophenol	2.000	μg/L
	4,6-Dinitro-o-cresol	24.000	μg/L
	2-Chlorophenol	3.700	μg/L
	4-Chloro-3-methylphenol	1.500	μg/L
	4-Nitrophenol	1.400	μg/L

ATG	PARAMETER	RMDL	RUNIT
20	m-Cresol	3.400	µg/L
	o-Cresol	3.700	µg/L
	p-Cresol	3.500	µg/L
	Pentachlorophenol	1.300	µg/L
	Phenol	2.400	µg/L
23	1,2,3,4-Tetrachlorobenzene	.010	µg/L
	1,2,3,5-Tetrachlorobenzene	.010	µg/L
	1,2,4,5-Tetrachlorobenzene	.010	µg/L
	1,2,3-Trichlorobenzene	.010	µg/L
	1,2,4-Trichlorobenzene	.010	µg/L
	2,4,5-Trichlorotoluene	.010	µg/L
	Hexachlorobenzene	.010	µg/L
	Hexachlorobutadiene	.010	µg/L
	Hexachlorocyclopentadiene	.010	µg/L
	Hexachloroethane	.010	µg/L
	Octachlorostyrene	.010	µg/L
	Pentachlorobenzene	.010	µg/L
24	2,3,7,8 TCDD	.020	ng/L
	Octachlorodibenzo-p-dioxin	.030	ng/L
	Octachlorodibenzofuran	.030	ng/L
	Total TCDD	.020	ng/L
	Total H7CDF	.030	ng/L
	Total PCDD	.020	ng/L
	Total H6CDF	.020	ng/L
	Total H7CDD	.030	ng/L
	Total PCDF	.015	ng/L
	Total H6CDD	.030	ng/L
	Total TCDF	.015	ng/L
25	Oil and grease	1.000	mg/L
27	PCBs (Total)	0.100	µg/L

APPENDIX C

QA/QC SUMMARY TABLES FOR ALL REFINERIES

LIST OF TABLES

Table 1: Preliminary List of Candidate Parameters C-1

Table 2: Average Process Effluent Concentration Ratio and Occurrence Classification For Candidate Parameters Monitored Daily or Thrice-Weekly C-2

Table 3: Average Process Effluent Concentration Ratio and Occurrence Classification For Candidate Parameters Monitored Quarterly and in Characterization C-3

Table 4: Average Process Effluent Travelling Blank Concentration Ratio For Candidate Parameters C-5

Table 5: Average Absolute Difference Concentration Ratio Between Process and Duplicate Data for Candidate Parameters C-7

Table 1 Preliminary List of Candidate Parameters

ATG	Parameter	Esso Sarnia	Petro-Canada Mississauga	Petro-Canada Oakville	Novacor Corunna	Shell Canada Sarnia	Suncor Inc. Sarnia	Esso Nanticoke
1	COD	X	X	X	X	X	X	X
2	Cyanide Total	X	X	X	X	X	X	X
3	Hydrogen ion (pH)	X	X	X	X	X	X	X
4a	Ammonia plus Ammonium	X	X	X	X	X	X	X
	Total Kjeldahl nitrogen	X	X	X	X	X		X
4b	Nitrate+Nitrite	X	X	X	X		X	X
5a	DOC	X	X	X	X	X	X	X
5b	TOC	X	X	X	X	X	X	X
6	Total phosphorus	X	X	X	X	X	X	X
7	Specific conductance	X	X	X	X	X	X	X
8	Total suspended solids	X	X	X	X	X	X	X
	VSS	X	X	X	X	X		
9	Aluminum	X	X	X	X	X	X	X
	Cadmium		X	X				
	Chromium		X	X	X	X		
	Copper						X	
	Molybdenum			X				X
	Vanadium		X					
	Zinc	X	X	X	X	X	X	X
10	Arsenic	X	X	X	X		X	X
	Selenium	X		X				X
11	Chromium (hexavalent)	.	.	.	.	.	.	X
12	Mercury		X					X
14	Phenolics (4AAP)	X	X	X	X	X	X	X
15	Sulphide	X	X	X	X	X	X	X
16	1,2-Dichloroethane		X	X				X
	1,2-Dichloropropane			X				
	Bromomethane			X				
	Chloroform		X		X		X	X
	Chloromethane			X				
	Methylene chloride							X
17	Benzene	X						
	Toluene	X				X		
	m-Xylene and p-Xylene	X						
	o-Xylene	X		X				
19	Naphthalene	X	X	X			X	
	Pyrene	X					X	
20	2,3,4,5-Tetrachlorophenol	X					X	
	2,3,4-Trichlorophenol	X					X	
	Pentachlorophenol		X	X				
23	1,2,3-Trichlorobenzene				X	X		
24	2,3,7,8 TCDD	X	X	X	X	X	X	
	Octachlorodibenzo-p-dioxin	X	X	X	X	X	X	
	Octachlorodibenzofuran	X	X	X	X	X	X	
	Total H6CDD	X	X	X	X	X	X	
	Total H6CDF				X	X		
	Total H7CDD				X	X	X	
	Total H7CDF	X	X	X	X	X	X	
	Total PCDD	X	X	X	X	X	X	
	Total PCDF	X	X	X	X	X	X	
	Total TCDD	X	X	X	X	X	X	
	Total TCDF	X	X	X	X	X	X	
25	Oil and grease	X	X	X	X	X	X	X

Note:

(X)	Indicates parameter selected by the corresponding refinery
(.)	Not monitored by that refinery

Table 2 Average Process Effluent Concentration Ratio and Occurrence Classification For Candidate Parameters Monitored Daily or Thrice-Weekly

		Esso Sarnia		Petro-Canada Mississauga		Petro-Canada Oakville		Novacor Corunna		Shell Canada Sarnia		Suncor Inc. Sarnia		Esso Nanticoke	
ATG	PARAMETER	RATIO	CLASS	RATIO	CLASS	RATIO	CLASS	RATIO	CLASS	RATIO	CLASS	RATIO	CLASS	RATIO	CLASS
4a	Ammonia plus Ammonium	2.3	FL	15.0	FM	19.4	FH	3.0	FL	1.9	IM	8.1	FM	1.4	IM
5a	DOC	19.2	FH	25.3	FH	35.8	FH	34.3	FH	37.6	FH	18.3	FH	14.5	FH
5b	TOC (1)	2.8	FM	3.9	FM	5.4	FM	4.2	FM	5.4	FM	2.0	FL	--	--
6	Total phosphorus	10.6	FH	2.2	FL	7.7	FH	2.9	FM	5.0	FM	2.0	FL	2.9	FM
8	Total suspended solids	2.6	FM	5.2	FM	4.5	FM	3.4	FM	13.0	FH	1.5	FL	1.4	FL
	VSS	1.1	FL	1.5	FL	1.5	FL	.9	FL	3.9	FL	.5	IL	.4	IL
9	Chromium (1)	--	--	6.3	FH	4.4	FM	12.3	FH	1.5	FL	--	--	--	--
	Zinc (1)	--	--	9.1	FH	142.0	FH	43.9	FH	3.5	FM	--	--	--	--
14	Phenolics (4AAP)	1.8	FL	4.5	FM	21.2	FH	2.9	FM	3.2	FM	3.5	FM	2.1	FL
15	Sulphide	2.1	FL	5.0	FM	8.4	FH	11.4	FH	1.2	IL	1.0	FL	1.9	FL
17	Benzene	3.7	FL	.3	IL	1.8	IH	.5	IL	2.9	IH	1.0	IH	.5	IM
	Toluene	3.8	FL	.3	IL	1.1	IH	.8	NO	2.3	IH	1.0	IH	.5	IL
	m-Xylene and p-Xylene	2.2	IM	.5	IH	1.0	IH	.4	NO	1.2	IM	.5	IM	.2	IL
	o-Xylene	3.3	FL	1.2	IH	8.2	IH	.8	NO	1.2	IH	1.0	IH	.3	IM
25	Oil and grease	1.2	IL	4.5	FM	2.5	FL	2.3	FL	3.5	FM	1.2	FL	1.8	FL

LEGEND

FH - frequently found (high level)
FL - frequently found (low level)
FM - frequently found (medium level)
IH - infrequently found (high level)
IL - infrequently found (low level)
IM - infrequently found (medium level)
NO - nonoccurrence

NOTE: (1) - Parameter sampled at lower frequency (see table 4.2).

Table 3 Average Process Effluent Concentration Ratio and Occurrence Classification For Candidate Parameters Monitored Quarterly and in Characterization

		Esso Sarnia		Petro-Canada Mississauga		Petro-Canada Oakville		Novacor Corunna		Shell Canada Sarnia		Suncor Inc. Sarnia		Esso Nanticoke	
ATG	PARAMETER	RATIO	CLASS	RATIO	CLASS	RATIO	CLASS	RATIO	CLASS	RATIO	CLASS	RATIO	CLASS	RATIO	CLASS
1	COD	3.5	FM	4.4	FM	10.4	FH	6.1	FH	5.0	FM	2.1	FM	3.1	FM
2	Cyanide Total	3.0	FL	.8	IM	1.2	FL	1.4	FL	1.8	FL	3.6	FM	2.4	FM
4a	Total Kjeldahl nitrogen	2.0	FL	4.0	FM	13.3	FH	4.5	FM	3.6	FM	.8	IL	2.4	FM
4b	Nitrate+Nitrite	24.0	FH	2.4	FL	1.0	FL	8.7	FH	.5	IL	32.6	FH	8.8	FH
5b	TOC (1)	--	--	--	--	--	--	--	--	--	--	--	--	1.4	FL
9	Aluminum	3.0	FL	8.9	FH	6.0	FM	10.4	FH	39.2	FH	6.0	FM	4.4	FM
	Cadmium	1.0	IL	3.1	FM	2.2	FM	1.0	NO	1.0	NO	1.0	NO	.1	NO
	Chromium (1)	1.0	NO	--	--	--	--	--	--	--	--	1.0	NO	.4	NO
	Copper	1.0	NO	.8	NO	.8	NO	.8	IM	.5	NO	2.1	FL	.7	IL
	Molybdenum	1.0	NO	1.8	IH	1.5	IM	.3	NO	.3	NO	1.0	NO	1.7	FM
	Vanadium	.9	IL	1.6	IM	.2	NO	.1	NO	.3	NO	.7	NO	.2	NO
	Zinc (1)	1.8	FM	--	--	--	--	--	--	--	--	5.2	FM	2.7	FM
10	Arsenic	1.7	FL	1.1	FL	3.2	FM	2.2	FL	.9	IL	.9	FL	2.3	FM
	Selenium	3.2	FM	.3	NO	1.1	IM	.6	NO	.6	NO	.7	IL	1.1	FL
11	Chromium (hexavalent) (2)	--	--	--	--	--	--	--	--	--	--	--	--	1.3	FL
12	Mercury	1.0	NO	1.0	IL	1.0	NO	.3	NO	.2	NO	1.0	NO	.8	FL
16	1,2-Dichloroethane	.3	NO	1.7	FL	1.7	FL	.5	NO	.5	NO	.3	NO	.8	FL
	1,2-Dichloropropane	.2	NO	.6	NO	1.6	FL	.6	NO	3.3	IM	.2	NO	.4	NO
	Bromomethane	.5	NO	1.6	IM	2.0	FL	.6	NO	.6	NO	.5	NO	.4	NO
	Chloroform	.3	NO	4.0	FL	.7	NO	1.1	FL	.6	NO	1.1	IH	2.1	FL
	Chloromethane	.5	NO	1.1	IL	1.8	FL	.6	NO	.6	NO	.5	NO	.6	IL
	Methylene chloride	.6	IL	1.2	NO	.4	NO	.6	IL	.2	NO	.7	NO	4.6	FM
19	Naphthalene	1.2	FL	.7	FL	.8	FL	.2	NO	.2	NO	1.2	FL	.2	NO
	Pyrene	1.2	FL	.8	NO	.8	NO	.7	NO	.7	NO	1.2	FL	.4	NO
20	2,3,4,5-Tetrachlorophenol	1.2	FL	1.0	NO	1.0	NO	1.0	NO	1.0	NO	1.2	FL	.3	NO
	2,3,4-Trichlorophenol	1.3	FL	.8	NO	.8	NO	.8	NO	.8	NO	1.3	FL	.3	NO
	Pentachlorophenol	.8	NO	1.1	FL	1.1	FL	.8	NO	.8	NO	.8	NO	.3	NO
23	1,2,3-Trichlorobenzene	.5	NO	1.0	NO	1.0	NO	1.5	FL	1.5	FL	.5	NO	.2	NO

Table 3 (cont'd) Average Process Effluent Concentration Ratio and Occurrence Classification For Candidate Parameters Monitored Quarterly and in Characterization

		Esso Sarnia		Petro-Canada Mississauga		Petro-Canada Oakville		Novacor Corunna		Shell Canada Sarnia		Suncor Inc. Sarnia		Esso Nanticoke	
ATG	PARAMETER	RATIO	CLASS	RATIO	CLASS	RATIO	CLASS	RATIO	CLASS	RATIO	CLASS	RATIO	CLASS	RATIO	CLASS
24	2,3,7,8 TCDD	2.0	FL	2.0	FL	2.0	FL	10.0	FH	10.9	FH	2.0	FL	1.5	FL
	Octachlorodibenzo-p-dioxin	4.0	FM	4.0	FM	12.0	FM	3.3	FM	4.4	FM	4.0	FM	3.0	FM
	Octachlorodibenzofuran	2.7	FL	2.0	FL	2.0	FL	6.7	FH	7.2	FH	3.3	FM	2.7	FM
	Total H6CDD	2.0	FL	2.0	FL	2.0	FL	3.3	FM	4.4	FM	2.0	FL	2.0	FL
	Total H6CDF	1.0	NO	1.0	NO	1.0	NO	10.0	FH	10.9	FH	1.0	NO	2.5	FM
	Total H7CDD	2.0	FL	.7	NO	.7	NO	3.3	FM	4.4	FM	1.7	FL	2.0	FL
	Total H7CDF	1.3	FL	1.3	FL	1.3	FL	3.3	FM	4.4	FM	1.3	FL	1.7	FL
	Total PCDD	3.0	FM	3.0	FM	3.0	FM	15.0	FH	15.0	FH	3.0	FM	1.0	NO
	Total PCDF	1.3	FL	1.3	FL	1.5	FL	20.0	FH	20.0	FH	1.3	FL	1.3	FL
	Total TCDD	2.0	FL	2.0	FL	2.0	FL	10.0	FH	10.9	FH	2.0	FL	1.5	FL
	Total TCDF	1.3	FL	1.3	FL	2.8	FL	20.0	FH	20.0	FH	1.3	FL	2.7	FM

LEGEND

FH - frequently found (high level)
FL - frequently found (low level)
FM - frequently found (medium level)
IH - infrequently found (high level)
IL - infrequently found (low level)
IM - infrequently found (medium level)
NO - nonoccurrence

NOTE: (1) - Parameter sampled at higher frequency (see table 4.1).

(2) - Requirement of Effluent Monitoring Regulation for Esso - Nanticoke only.

Table 4 Average Process Effluent Travelling Blank Concentration Ratio For Candidate Parameters

ATG	PARAMETER	Esso Sarnia	Petro-Canada Mississauga	Petro-Canada Oakville	Novacor Corunna	Shell Canada Sarnia	Suncor Inc. Sarnia	Esso Nanticoke
1	COD	.6	.8	.8	.7	.7	.5	.5
2	Cyanide Total	1.0	.2	.2	.4	.4	1.0	3.6
4a	Ammonia plus Ammonium	.5	.2	3.3	.4	.8	.7	.2
4a	Total Kjeldahl nitrogen	.2	.2	.2	.6	.7	.7	.1
4b	Nitrate+Nitrite	.2	.1	.1	.1	.1	.2	.1
5a	OOC	1.7	3.2	.4	1.1	3.2	.6	.5
5b	TOC	.2	.5	.2	.4	.7	.1	.1
6	Total phosphorus	.9	.6	.7	.3	.6	.4	1.0
8	Total suspended solids (1)	1.0	--	--	.8	--	--	--
	VSS (1)	.5	--	--	.3	--	--	--
9	Aluminum	1.2	2.0	.6	2.1	1.9	1.0	1.2
	Cadmium	1.0	2.4	35.9	1.0	1.0	1.0	.1
	Chromium	1.0	.3	.3	.7	.9	1.0	.6
	Copper	1.0	.8	.8	.3	.3	1.0	.6
	Molybdenum	1.0	.2	.2	.3	.3	1.0	.2
	Vanadium	.7	.2	.2	.1	.1	.7	.2
	Zinc	1.0	1.6	133.4	1.1	3.4	1.0	1.0
10	Arsenic	.4	.1	.1	.6	.5	.4	.5
	Selenium	.4	.2	.2	.6	.5	.4	.2
11	Chromium (hexavalent) (2)	--	--	--	--	--	--	.3
12	Mercury	1.0	1.0	1.0	.2	.2	1.0	.6
14	Phenolics (4AAP)	.9	1.0	.5	1.0	1.0	.6	1.0
15	Sulphide	.9	.6	1.0	1.2	1.0	.5	1.1
16	1,2-Dichloroethane	.2	2.2	1.8	.5	.5	.2	.8
	1,2-Dichloropropane	.2	.6	.6	.6	.6	.2	.4
	Bromomethane	.5	1.0	1.1	.6	.6	.5	.8
	Chloroform	.3	1.8	.7	.6	.6	.3	1.7
	Chloromethane	.5	.9	.9	.6	.6	.5	1.3
	Methylene chloride	.6	2.8	.3	1.7	1.5	.6	3.5

Table 4 (cont'd) Average Process Effluent Travelling Blank Concentration Ratio For Candidate Parameters

ATG	PARAMETER	Esso Sarnia	Petro-Canada Mississauga	Petro-Canada Oakville	Novacor Corunna	Shell Canada Sarnia	Suncor Inc. Sarnia	Esso Nanticoke
17	Benzene	1.3	.3	.2	.5	1.1	.7	.7
	Toluene	1.7	.2	.3	.8	1.6	.4	.7
	m-Xylene and p-Xylene	2.6	.1	.1	.4	.8	.4	.2
	o-Xylene	3.0	.2	.2	.8	.7	.6	.4
19	Naphthalene	1.2	.8	.8	.2	.2	1.2	.2
	Pyrene	1.2	.7	.7	.7	.7	1.2	.4
20	2,3,4,5-Tetrachlorophenol	1.2	1.0	1.0	1.0	1.0	1.2	.3
	2,3,4-Trichlorophenol	1.3	.8	.8	.8	.8	1.3	.3
	Pentachlorophenol	.8	1.1	1.1	.8	.8	.8	.3
23	1,2,3-Trichlorobenzene (1)	--	--	--	1.5	--	--	--
24	2,3,7,8 TCDD (1)	--	--	--	10.0	--	--	--
	Octachlorodibenzo-p-dioxin (1)	--	--	--	3.3	--	--	--
	Octachlorodibenzofuran (1)	--	--	--	6.7	--	--	--
	Total H6CDD (1)	--	--	--	3.3	--	--	--
	Total H6CDF (1)	--	--	--	10.0	--	--	--
	Total H7CDD (1)	--	--	--	3.3	--	--	--
	Total H7CDF (1)	--	--	--	3.3	--	--	--
	Total PCDD (1)	--	--	--	15.0	--	--	--
	Total PCDF (1)	--	--	--	20.0	--	--	--
	Total TCDD (1)	--	--	--	10.0	--	--	--
	Total TCDF (1)	--	--	--	20.0	--	--	--
25	Oil and grease	1.3	.7	.4	1.0	2.4	.5	1.1

NOTE: (1) - Not a requirement of Effluent Monitoring Regulation but data were provided by the discharger.

(2) - Requirement of Effluent Monitoring Regulation for Esso - Nanticoke only.

Table 5 Average Absolute Difference Concentration Ratio Between Process and Duplicate Data for Candidate Parameters

ATG	PARAMETER	Esso Sarnia	Petro-Canada Mississauga	Petro-Canada Oakville	Novacor Corunna	Shell Canada Sarnia	Suncor Inc. Sarnia	Esso Nanticoke
1	COD	2.1	2.5	.4	2.2	2.0	.2	.2
2	Cyanide Total	.5	.1	.2	.5	.1	2.0	1.1
4a	Ammonia plus Ammonium	.1	11.0	.9	.2	.1	.7	.1
	Total Kjeldahl nitrogen	.4	.4	1.4	.3	.7	.0	.4
4b	Nitrate+Nitrite	.1	.1	.1	1.2	.0	4.1	.0
5a	DOC	1.4	2.8	1.0	2.8	10.8	1.5	4.0
5b	TOC	.2	.4	.2	.3	.9	.1	.1
6	Total phosphorus	1.1	.2	.7	.4	1.9	.3	.9
8	Total suspended solids	.4	.4	.2	.3	5.6	.2	.5
	VSS	.1	.2	.1	.1	1.8	.1	.2
9	Aluminum	.0	3.0	5.2	6.2	16.4	.4	.0
	Cadmium	.0	.5	.8	2.4	.0	.0	.0
	Chromium	.0	.4	.7	.8	2.1	.0	.1
	Copper	.0	.0	.4	.4	.1	.0	.2
	Molybdenum	.0	.2	.4	.0	.0	.0	.3
	Vanadium	.3	.1	.1	.0	.1	.0	.0
	Zinc	.2	2.4	.7	2.0	1.7	.8	.2
10	Arsenic	.1	.1	1.3	.2	.4	.1	.0
	Selenium	.2	.0	0.7	.0	.0	.2	.0
11	Chromium (hexavalent) (2)	--	--	--	--	--	--	.0
12	Mercury	.0	.1	.5	.3	.1	.0	.0
14	Phenolics (4AAP)	.1	.2	.9	.8	.3	.3	1.7
15	Sulphide	.9	2.0	.4	2.4	.0	.2	.4
16	1,2-Dichloroethane	.1	.5	1.1	.0	.0	.0	.0
	1,2-Dichloropropane	.1	.0	.1	.0	.0	.0	.0
	Bromomethane	.2	.6	.2	.0	.0	.0	.0
	Chloroform	.1	1.5	.0	.1	.0	.0	1.5
	Chloromethane	.2	.1	.8	.0	.0	.0	.7
	Methylene chloride	.5	2.5	.0	.1	.0	.5	.7
17	Benzene	1.1	.1	.0	.0	1.4	.4	.5
	Toluene	1.4	.0	.2	.1	4.7	.9	.1
	m-Xylene and p-Xylene	1.5	.0	.0	.0	2.0	.4	.0
	o-Xylene	.5	.1	.3	.1	.5	1.7	.0
19	Naphthalene	.0	.0	.4	.0	.0	.0	.0
	Pyrene	.0	.0	.0	.0	.0	.0	.0

NOTE: Average Difference Ratio = Process Effluent Concentration - Duplicate Sample Concentration Divided by Regulation Method Detection Limit

Table 5 (cont'd) Average Absolute Difference Concentration Ratio Between Process and Duplicate Data for Candidate Parameters

ATG	PARAMETER	Esso Sarnia	Petro-Canada Mississauga	Petro-Canada Oakville	Novacor Corunna	Shell Canada Sarnia	Suncor Inc. Sarnia	Esso Nanticoke
20	2,3,4,5-Tetrachlorophenol	.0	.0	.0	.0	.0	.0	.0
	2,3,4-Trichlorophenol	.0	.0	.0	.0	.0	.0	.0
	Pentachlorophenol	.0	.0	.0	.0	.0	.0	.0
23	1,2,3-Trichlorobenzene (1)	--	--	--	.0	--	--	--
24	2,3,7,8 TCDD (1)	--	--	--	.0	--	--	--
	Octachlorodibenzo-p-dioxin (1)	--	--	--	.0	--	--	--
	Octachlorodibenzofuran (1)	--	--	--	.0	--	--	--
	Total H6CDD (1)	--	--	--	.0	--	--	--
	Total H6CDF (1)	--	--	--	.0	--	--	--
	Total H7CDD (1)	--	--	--	.0	--	--	--
	Total H7CDF (1)	--	--	--	.0	--	--	--
	Total PCDD (1)	--	--	--	.0	--	--	--
	Total PCDF (1)	--	--	--	.0	--	--	--
	Total TCDD (1)	--	--	--	.0	--	--	--
	Total TCDF (1)	--	--	--	.0	--	--	--
25	Oil and grease	.1	.3	.3	.5	2.5	.4	.6

NOTE: (1) - Not a requirement of Effluent Monitoring but data were provided by the discharger.

(2) - Requirement of Effluent Monitoring Regulation for Esso - Nanticoke only.

Average Difference Ratio = Process Effluent Concentration - Duplicate Sample Concentration Divided by Regulation Method Detection Limit

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QA/QC OUTPUT TABLES BY REFINERY

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Table 1.1
Detection Frequencies and Concentration Ratios For Candidate Parameters Monitored Daily and Thrice-Weekly Process Effluent from Esso Petroleum Canada (Sarnia)

Parameter	Number of Observations	Frequency of Detection (%)			Concentration Ratios (1)		
		>RMDL	>2RMDL	>5RMDL	Minimum	Maximum	Average
DOC	157	99	99	99	1.00	34.00	19.20
TOC	157	99	82	4	.46	17.60	2.81
Total suspended solids	148	97	68	2	.38	9.24	2.56
Total phosphorus	152	95	94	80	.20	348.00	10.56
Sulphide	157	86	33	8	.10	30.00	2.10
Ammonia plus Ammonium	157	85	38	4	.36	44.00	2.25
Phenolics (4AAP)	351	83	38	2	1.00	9.50	1.75
Toluene	151	60	41	19	.40	34.20	3.85
Benzene	151	56	39	21	.20	43.80	3.68
VSS	332	52	4	1	.10	5.67	1.10
o-Xylene	151	51	35	16	.40	59.40	3.27
m-Xylene and p-Xylene	151	38	27	11	.10	50.27	2.23
Oil and grease	157	23	5	1	1.00	9.70	1.20

NOTE: (1) Concentration Ratio = Concentration divided by Regulation Method Detection Limit

Table 1.2
Detection Frequencies and Concentration Ratios For Candidate Parameters Monitored Daily and Thrice-Weekly Process Effluent from Petro-Canada Inc., Lake Ontario Refinery - Mississauga Plant

Parameter	Number of Observations	Frequency of Detection (%)			Concentration Ratios (1)		
		>RMDL	>2RMDL	>5RMDL	Minimum	Maximum	Average
DOC	155	100	100	100	8.00	93.00	25.31
Total suspended solids	258	100	79	25	.94	110.24	5.24
TOC	155	99	91	17	.74	11.20	3.89
Zinc	159	97	93	70	.70	127.00	9.14
Oil and grease	156	97	87	32	.71	18.70	4.50
Chromium	160	96	91	66	.10	27.50	6.30
Phenolics (4AAP)	362	94	73	27	.90	35.50	4.45
Sulphide	157	91	72	32	.50	43.50	4.95
Ammonia plus Ammonium	155	75	66	50	.16	280.00	15.02
Total phosphorus	155	56	37	7	.60	31.00	2.21
VSS	361	55	14	2	.10	39.12	1.54
o-Xylene	156	6	5	4	.20	41.00	1.22
m-Xylene and p-Xylene	156	3	2	2	.10	20.00	.51
Benzene	156	3	1	0	.20	3.38	.31
Toluene	156	2	1	0	.20	2.12	.25

NOTE: (1) Concentration Ratio = Concentration divided by Regulation Method Detection Limit

Table 1.3
Detection Frequencies and Concentration Ratios For Candidate Parameters Monitored Daily and Thrice-Weekly Process Effluent from Petro-Canada Inc., Lake Ontario Refinery - Oakville Plant

Parameter	Number of Observations	Frequency of Detection (%)			Concentration Ratios (1)		
		>RMDL	>2RMDL	>5RMDL	Minimum	Maximum	Average
DOC	155	100	100	100	17.60	144.00	35.82
Ammonia plus Ammonium	156	100	100	99	4.40	92.40	19.44
Phenolics (4AAP)	365	100	100	99	4.00	148.00	21.18
Sulphide	156	100	100	79	2.00	20.00	8.40
TOC	155	100	100	43	2.60	20.00	5.39
Total suspended solids	159	100	96	26	1.00	38.20	4.47
Zinc	155	99	96	52	.70	3,120.00	141.97
Chromium	155	99	86	35	.85	34.50	4.42
Total phosphorus	155	97	94	68	.62	36.80	7.74
Oil and grease	156	77	37	9	.35	18.20	2.46
VSS	364	77	23	0	.40	4.70	1.45
o-Xylene	156	19	19	11	.20	203.80	8.24
Benzene	156	5	4	3	.20	110.80	1.79
Toluene	156	4	3	3	.20	67.60	1.12
m-Xylene and p-Xylene	156	3	3	3	.10	56.55	1.01

NOTE: (1) Concentration Ratio = Concentration divided by Regulation Method Detection Limit

Table 1.4
Detection Frequencies and Concentration Ratios For Candidate Parameters Monitored Daily and Thrice-Weekly Process Effluent from Novacor (Corunna)

Parameter	Number of Observations	Frequency of Detection (%)			Concentration Ratios (1)		
		>RMDL	>2RMDL	>5RMDL	Minimum	Maximum	Average
DOC	152	100	100	100	6.00	158.00	34.28
Zinc	144	100	99	95	1.00	101.00	43.86
TOC	149	100	96	18	1.20	16.60	4.22
Total suspended solids	157	100	94	14	1.20	8.20	3.37
Sulphide	153	98	98	90	.95	32.50	11.35
Phenolics (4AAP)	351	93	74	11	1.00	16.50	2.92
Chromium	139	91	87	87	.33	27.50	12.31
Total phosphorus	153	88	52	18	.40	12.60	2.92
Ammonia plus Ammonium	153	83	48	8	.32	39.20	2.95
Oil and grease	153	49	33	13	1.00	15.00	2.27
VSS	354	42	1	0	.30	2.50	.92
Benzene	153	1	0	0	.44	1.60	.49
Toluene	153	0	0	0	.78	.79	.78
m-Xylene and p-Xylene	153	0	0	0	.44	.45	.44
o-Xylene	153	0	0	0	.82	.84	.84

NOTE: (1) Concentration Ratio = Concentration divided by Regulation Method Detection Limit

Table 1.5
Detection Frequencies and Concentration Ratios For Candidate Parameters Monitored Daily and Thrice-Weekly Process Effluent from Shell Canada Products Limited (Sarnia)

Parameter	Number of Observations	Frequency of Detection (%)			Concentration Ratios (1)		
		>RMDL	>2RMDL	>5RMDL	Minimum	Maximum	Average
DOC	160	100	100	100	6.00	512.00	37.61
TOC	161	99	92	35	.80	61.60	5.42
Phenolics (4AAP)	361	98	75	16	1.00	35.00	3.25
Total suspended solids	361	97	94	65	.80	207.60	12.95
Oil and grease	261	92	73	22	.98	15.00	3.45
Zinc	160	84	54	19	.55	80.00	3.45
Total phosphorus	161	80	63	37	.10	32.30	4.96
VSS	361	79	46	20	.20	66.60	3.87
Chromium	160	41	18	3	.35	7.50	1.47
Toluene	159	23	15	9	.78	49.60	2.31
Ammonia plus Ammonium	261	17	13	5	.16	67.60	1.88
Benzene	160	14	11	7	.48	164.45	2.86
m-Xylene and p-Xylene	159	8	8	4	.44	38.96	1.16
o-Xylene	160	6	3	2	.70	33.60	1.17
Sulphide	228	6	2	1	1.00	30.00	1.20

NOTE: (1) Concentration Ratio = Concentration divided by Regulation Method Detection Limit

Table 1.6
Detection Frequencies and Concentration Ratios For Candidate Parameters Monitored Daily and Thrice-Weekly Process Effluent from Suncor Inc. (Sarnia)

Parameter	Number of Observations	Frequency of Detection (%)			Concentration Ratios (1)		
		>RMDL	>2RMDL	>5RMDL	Minimum	Maximum	Average
DOC	154	99	99	99	.60	182.00	18.29
Phenolics (4AAP)	357	96	65	20	.50	60.00	3.45
TOC	156	91	20	5	.14	17.60	2.04
Total suspended solids	304	89	12	0	.40	26.00	1.46
Ammonia plus Ammonium	162	85	62	31	.40	80.00	8.07
Total phosphorus	151	72	31	7	.40	15.00	2.04
Sulphide	152	49	11	0	.50	4.00	.95
Oil and grease	154	45	12	3	.10	8.90	1.20
Toluene	159	13	7	4	.40	30.40	1.03
o-Xylene	159	4	4	3	.40	11.80	.96
VSS	355	3	0	0	.10	2.00	.46
m-Xylene and p-Xylene	159	2	2	0	.18	3.91	.45
Benzene	159	2	1	1	.20	22.60	.99

NOTE: (1) Concentration Ratio = Concentration divided by Regulation Method Detection Limit

Table 1.7
Detection Frequencies and Concentration Ratios For Candidate Parameters Monitored Daily and Thrice-Weekly Process Effluent from Esso Petroleum Canada (Nanticoke)

Parameter	Number of Observations	Frequency of Detection (%)			Concentration Ratios (1)		
		>RMDL	>2RMDL	>5RMDL	Minimum	Maximum	Average
DOC	163	100	100	99	4.20	70.00	14.52
Total phosphorus	164	85	63	16	.10	13.00	2.90
Phenolics (4AAP)	363	82	48	6	.10	10.00	2.09
Oil and grease	163	74	29	2	.70	6.50	1.83
Total suspended solids	160	67	18	0	.40	3.80	1.37
Sulphide	162	64	36	11	.10	15.00	1.90
Ammonia plus Ammonium	160	25	13	7	.10	35.16	1.36
Benzene	160	6	4	0	.26	4.20	.51
Toluene	160	3	1	0	.10	2.58	.52
VSS	360	3	0	0	.10	1.28	.43
o-Xylene	160	1	1	0	.10	3.04	.32
m-Xylene and p-Xylene	160	1	0	0	.10	1.53	.19

NOTE: (1) Concentration Ratio = Concentration divided by Regulation Method Detection Limit

Table 2.1
Detection Frequencies and Concentration Ratios For Candidate Parameters Monitored Quarterly and Semi-Annually Process Effluent from Esso Petroleum Canada (Sarnia)

Parameter	Number of Observations	Frequency of Detection (%)			Concentration Ratios (1)		
		>RMDL	>2RMDL	>5RMDL	Minimum	Maximum	Average
Nitrate+Nitrite	12	100	100	100	14.76	33.40	24.04
COD	12	100	100	0	2.80	4.10	3.48
2,3,4,5-Tetrachlorophenol	12	100	0	0	1.25	1.25	1.25
2,3,4-Trichlorophenol	12	100	0	0	1.33	1.33	1.33
Naphthalene	12	100	0	0	1.25	1.25	1.25
Pyrene	12	100	0	0	1.25	1.25	1.25
Selenium	12	92	83	0	.40	4.80	3.17
Cyanide Total	12	92	50	8	1.00	17.00	3.00
Arsenic	12	92	33	0	.40	2.60	1.67
Zinc	12	83	58	0	.10	4.20	1.83
Aluminum	12	75	42	17	.10	12.80	3.02
Vanadium	12	17	8	0	.67	2.33	.86
Cadmium	12	17	0	0	1.00	1.50	1.04
Methylene chloride	12	17	0	0	.38	1.46	.57
Copper	12	8	0	0	1.00	1.40	1.03
1,2-Dichloroethane	12	0	0	0	.25	.50	.29
1,2-Dichloropropane	12	0	0	0	.22	.22	.22
Bromomethane	12	0	0	0	.54	.54	.54
Chloroform	12	0	0	0	.29	.71	.33
Chloromethane	12	0	0	0	.54	.54	.54
Chromium	12	0	0	0	1.00	1.00	1.00
Mercury	12	0	0	0	1.00	1.00	1.00
Molybdenum	12	0	0	0	1.00	1.00	1.00
Pentachlorophenol	12	0	0	0	.77	.77	.77
Total Kjeldahl nitrogen	10	100	50	0	1.62	2.52	1.99
Octachlorodibenzo-p-dioxin	2	100	100	0	4.00	4.00	4.00
Total PCDD	2	100	100	0	3.00	3.00	3.00
Octachlorodibenzofuran	2	100	50	0	2.00	3.33	2.67
2,3,7,8 TCDD	2	100	0	0	2.00	2.00	2.00
Total H6CDD	2	100	0	0	2.00	2.00	2.00
Total H7CDF	2	100	0	0	1.33	1.33	1.33
Total PCDF	2	100	0	0	1.33	1.33	1.33
Total TCDD	2	100	0	0	2.00	2.00	2.00
Total TCDF	2	100	0	0	1.33	1.33	1.33
1,2,3-Trichlorobenzene	2	0	0	0	.50	.50	.50
Total H6CDF	2	0	0	0	1.00	1.00	1.00
Total H7CDD	1	100	0	0	2.00	2.00	2.00

NOTE: (1) Concentration Ratio = Concentration divided by Regulation Method Detection Limit

Table 2.2
Detection Frequencies and Concentration Ratios For Candidate Parameters Monitored Quarterly and Semi-Annually Process Effluent from Petro-Canada Inc., Lake Ontario Refinery - Mississauga

Parameter	Number of Observations	Frequency of Detection (%)			Concentration Ratios (1)		
		>RMDL	>2RMDL	>5RMDL	Minimum	Maximum	Average
COD	12	100	100	25	2.00	8.40	4.41
Total Kjeldahl nitrogen	12	100	92	25	1.20	10.36	3.99
Chloroform	12	67	42	25	.43	20.86	3.95
Nitrate+Nitrite	12	67	25	8	.16	13.64	2.35
1,2-Dichloroethane	12	50	50	0	.75	2.62	1.75
Cyanide Total	12	33	25	0	.20	2.40	.80
Bromomethane	12	25	25	0	1.00	3.51	1.63
Chloromethane	12	25	0	0	.95	1.41	1.06
Methylene chloride	12	8	8	8	.31	10.42	1.24
1,2-Dichloropropane	12	0	0	0	.56	.56	.56
Aluminum	11	100	100	82	2.17	20.67	8.92
Cadmium	11	100	100	0	3.00	4.50	3.14
Pentachlorophenol	11	55	0	0	1.00	1.15	1.08
Arsenic	11	45	9	0	.40	2.40	1.07
Naphthalene	11	45	0	0	.44	1.12	.75
Vanadium	11	36	27	0	.17	4.67	1.62
Mercury	11	36	0	0	1.00	1.50	1.05
Molybdenum	11	27	27	27	.25	5.50	1.75
Pyrene	11	9	0	0	.50	1.57	.78
2,3,4,5-Tetrachlorophenol	11	0	0	0	1.00	1.00	1.00
2,3,4-Trichlorophenol	11	0	0	0	.83	.83	.83
Copper	11	0	0	0	.60	.83	.78
Selenium	11	0	0	0	.28	.50	.35
Octachlorodibenzo-p-dioxin	2	100	100	0	4.00	4.00	4.00
Total PCDD	2	100	100	0	3.00	3.00	3.00
2,3,7,8 TCDD	2	100	0	0	2.00	2.00	2.00
Octachlorodibenzofuran	2	100	0	0	2.00	2.00	2.00
Total H6CDD	2	100	0	0	2.00	2.00	2.00
Total H7CDF	2	100	0	0	1.33	1.33	1.33
Total PCDF	2	100	0	0	1.33	1.33	1.33
Total TCDD	2	100	0	0	2.00	2.00	2.00
Total TCDF	2	100	0	0	1.33	1.33	1.33
1,2,3-Trichlorobenzene	2	0	0	0	1.00	1.00	1.00
Total H6CDF	2	0	0	0	1.00	1.00	1.00
Total H7CDD	2	0	0	0	.67	.67	.67

NOTE: (1) Concentration Ratio = Concentration divided by Regulation Method Detection Limit

Table 2.3
Detection Frequencies and Concentration Ratios For Candidate Parameters Monitored Quarterly and Semi-Annually Process Effluent from Petro-Canada Inc., Lake Ontario Refinery - Oakville Plant

Parameter	Number of Observations	Frequency of Detection (%) >RMDL	>2RMDL	>5RMDL	Concentration Ratios (1) Minimum	Maximum	Average
Bromomethane	13	69	23	8	1.00	5.35	1.99
1,2-Dichloroethane	13	46	46	0	1.00	2.62	1.75
1,2-Dichloropropane	13	46	31	0	.56	4.33	1.63
Chloromethane	13	46	31	0	.95	3.73	1.80
Chloroform	13	0	0	0	.71	.71	.71
Methylene chloride	13	0	0	0	.31	.65	.36
COD	12	100	100	100	6.30	26.90	10.38
Total Kjeldahl nitrogen	12	100	100	92	3.02	39.00	13.28
Arsenic	12	100	67	25	1.00	6.80	3.20
Aluminum	12	75	75	42	.20	14.47	5.96
Cadmium	12	67	67	0	.50	3.00	2.17
Cyanide Total	12	67	0	0	.20	1.80	1.20
Naphthalene	12	50	0	0	.44	1.12	.81
Pentachlorophenol	12	50	0	0	1.00	1.15	1.08
Nitrate+Nitrite	12	42	0	0	.51	1.88	1.03
Selenium	12	33	25	0	.10	2.72	1.13
Molybdenum	12	33	17	8	.45	5.80	1.48
Pyrene	12	8	0	0	.50	1.30	.84
2,3,4,5-Tetrachlorophenol	12	0	0	0	1.00	1.00	1.00
2,3,4-Trichlorophenol	12	0	0	0	.83	.83	.83
Copper	12	0	0	0	.80	.80	.80
Mercury	12	0	0	0	1.00	1.00	1.00
Vanadium	12	0	0	0	.17	.17	.17
Octachlorodibenzo-p-dioxin	2	100	100	50	2.37	21.67	12.03
Total PCDD	2	100	100	0	3.00	3.00	3.00
Total TCDF	2	100	50	0	1.33	4.33	2.80
2,3,7,8 TCDD	2	100	0	0	2.00	2.00	2.00
Octachlorodibenzofuran	2	100	0	0	2.00	2.00	2.00
Total H6CDD	2	100	0	0	2.00	2.00	2.00
Total H7CDF	2	100	0	0	1.33	1.33	1.33
Total PCDF	2	100	0	0	1.33	1.60	1.47
Total TCDD	2	100	0	0	2.00	2.00	2.00
1,2,3-Trichlorobenzene	2	0	0	0	1.00	1.00	1.00
Total H6CDF	2	0	0	0	1.00	1.00	1.00
Total H7CDD	2	0	0	0	.67	.67	.67

NOTE: (1) Concentration Ratio = Concentration divided by Regulation Method Detection Limit

Table 2.4
Detection Frequencies and Concentration Ratios For Candidate Parameters Monitored Quarterly and Semi-Annually Process Effluent from Novacor (Corunna)

Parameter	Number of Observations	Frequency of Detection (%)			Concentration Ratios (1)		
		>RMDL	>2RMDL	>5RMDL	Minimum	Maximum	Average
Aluminum	12	100	100	100	6.00	16.67	10.42
Nitrate+Nitrite	12	100	100	92	4.00	10.80	8.73
COD	12	100	100	67	3.00	9.90	6.09
Total Kjeldahl nitrogen	12	100	100	25	3.40	7.20	4.50
Cyanide Total	12	75	25	0	.60	2.80	1.40
Arsenic	12	50	25	17	.60	7.60	2.20
Chloroform	12	50	0	0	.53	1.86	1.08
Copper	12	25	17	0	.30	3.00	.81
Methylene chloride	12	25	8	0	.23	2.46	.65
Mercury	12	8	0	0	.19	1.30	.28
1,2-Dichloroethane	12	0	0	0	.50	.50	.50
1,2-Dichloropropane	12	0	0	0	.56	.56	.56
2,3,4,5-Tetrachlorophenol	12	0	0	0	1.00	1.00	1.00
2,3,4-Trichlorophenol	12	0	0	0	.83	.83	.83
Bromomethane	12	0	0	0	.65	.65	.65
Cadmium	12	0	0	0	1.00	1.00	1.00
Chloromethane	12	0	0	0	.62	.62	.62
Molybdenum	12	0	0	0	.30	.30	.30
Naphthalene	12	0	0	0	.19	.19	.19
Pentachlorophenol	12	0	0	0	.77	.85	.83
Pyrene	12	0	0	0	.75	.75	.75
Selenium	12	0	0	0	.60	.60	.60
Vanadium	12	0	0	0	.10	.10	.10
2,3,7,8 TCDD	4	100	100	100	10.00	10.00	10.00
Octachlorodibenzofuran	4	100	100	100	6.67	6.67	6.67
Total H6CDF	4	100	100	100	10.00	10.00	10.00
Total PCDD	4	100	100	100	15.00	15.00	15.00
Total PCDF	4	100	100	100	20.00	20.00	20.00
Total TCDD	4	100	100	100	10.00	10.00	10.00
Total TCDF	4	100	100	100	20.00	20.00	20.00
Octachlorodibenzo-p-dioxin	4	100	100	0	3.33	3.33	3.33
Total H6CDD	4	100	100	0	3.33	3.33	3.33
Total H7CDD	4	100	100	0	3.33	3.33	3.33
Total H7CDF	4	100	100	0	3.33	3.33	3.33
1,2,3-Trichlorobenzene	4	100	0	0	1.50	1.50	1.50

NOTE: (1) Concentration Ratio = Concentration divided by Regulation Method Detection Limit

Table 2.5
Detection Frequencies and Concentration Ratios For Candidate Parameters Monitored Quarterly and Semi-Annually Process Effluent from Shell Canada Products Limited (Sarnia)

Parameter	Number of Observations	Frequency of Detection (%)			Concentration Ratios (1)		
		>RMDL	>2RMDL	>5RMDL	Minimum	Maximum	Average
Aluminum	12	100	100	100	7.33	90.00	39.19
COD	12	100	92	50	1.30	11.00	4.98
Cyanide Total	12	92	33	0	.80	3.20	1.80
Total Kjeldahl nitrogen	12	75	75	25	.52	9.80	3.55
Arsenic	12	25	8	0	.60	2.60	.92
1,2-Dichloropropane	12	17	17	8	.56	30.00	3.32
Copper	12	8	0	0	.30	1.10	.49
1,2-Dichloroethane	12	0	0	0	.50	.50	.50
2,3,4,5-Tetrachlorophenol	12	0	0	0	1.00	1.00	1.00
2,3,4-Trichlorophenol	12	0	0	0	.83	.83	.83
Bromomethane	12	0	0	0	.65	.65	.65
Cadmium	12	0	0	0	1.00	1.00	1.00
Chloroform	12	0	0	0	.57	.57	.57
Chloromethane	12	0	0	0	.62	.62	.62
Mercury	12	0	0	0	.19	.19	.19
Methylene chloride	12	0	0	0	.23	.23	.23
Molybdenum	12	0	0	0	.30	.30	.30
Naphthalene	12	0	0	0	.19	.19	.19
Pentachlorophenol	12	0	0	0	.77	.85	.83
Pyrene	12	0	0	0	.75	.75	.75
Selenium	12	0	0	0	.60	.60	.60
Vanadium	12	0	0	0	.10	.93	.27
Nitrate+Nitrite	9	22	0	0	.10	1.40	.49
2,3,7,8 TCDD	3	100	100	100	10.00	12.50	10.85
Octachlorodibenzofuran	3	100	100	100	6.67	8.33	7.23
Total H6CDF	3	100	100	100	10.00	12.50	10.85
Total PCDD	3	100	100	100	15.00	15.00	15.00
Total PCDF	3	100	100	100	20.00	20.00	20.00
Total TCDD	3	100	100	100	10.00	12.50	10.85
Total TCDF	3	100	100	100	20.00	20.00	20.00
Octachlorodibenzo-p-dioxin	3	100	100	33	3.33	6.67	4.43
Total H6CDD	3	100	100	33	3.33	6.67	4.43
Total H7CDD	3	100	100	33	3.33	6.67	4.43
Total H7CDF	3	100	100	33	3.33	6.67	4.43
1,2,3-Trichlorobenzene	3	100	0	0	1.50	1.50	1.50

NOTE: (1) Concentration Ratio = Concentration divided by Regulation Method Detection Limit

Table 2.6
Detection Frequencies and Concentration Ratios For Candidate Parameters Monitored Quarterly and Semi-Annually Process Effluent from Suncor Inc. (Sarnia)

Parameter	Number of Observations	Frequency of Detection (%)			Concentration Ratios (1)		
		>RMDL	>2RMDL	>5RMDL	Minimum	Maximum	Average
Zinc	12	100	100	42	2.00	11.00	5.17
2,3,4,5-Tetrachlorophenol	12	100	0	0	1.25	1.25	1.25
2,3,4-Trichlorophenol	12	100	0	0	1.33	1.33	1.33
Naphthalene	12	100	0	0	1.25	1.25	1.25
Pyrene	12	100	0	0	1.25	1.25	1.25
COD	12	92	75	0	.80	2.70	2.07
Aluminum	12	75	67	33	1.00	24.00	5.97
Cyanide Total	12	67	58	33	1.00	12.00	3.60
Copper	12	42	8	8	1.00	14.00	2.08
Arsenic	12	42	0	0	.60	1.60	.92
Chloroform	12	33	8	8	.29	5.57	1.10
Selenium	12	17	0	0	.40	1.20	.65
Methylene chloride	12	8	8	0	.38	4.15	.70
1,2-Dichloroethane	12	0	0	0	.25	.37	.26
1,2-Dichloropropane	12	0	0	0	.22	.22	.22
Bromomethane	12	0	0	0	.54	.54	.54
Cadmium	12	0	0	0	1.00	1.00	1.00
Chloromethane	12	0	0	0	.54	.54	.54
Chromium	12	0	0	0	1.00	1.00	1.00
Mercury	12	0	0	0	1.00	1.00	1.00
Molybdenum	12	0	0	0	1.00	1.00	1.00
Pentachlorophenol	12	0	0	0	.77	.77	.77
Vanadium	12	0	0	0	.67	.67	.67
Nitrate+Nitrite	9	100	100	100	8.12	55.60	32.65
Total Kjeldahl nitrogen	9	33	0	0	.20	1.20	.82
Octachlorodibenzo-p-dioxin	2	100	100	0	4.00	4.00	4.00
Octachlorodibenzofuran	2	100	100	0	3.33	3.33	3.33
Total PCDD	2	100	100	0	3.00	3.00	3.00
2,3,7,8 TCDD	2	100	0	0	2.00	2.00	2.00
Total H6CDD	2	100	0	0	2.00	2.00	2.00
Total H7CDD	2	100	0	0	1.33	2.00	1.67
Total H7CDF	2	100	0	0	1.33	1.33	1.33
Total PCDF	2	100	0	0	1.33	1.33	1.33
Total TCDD	2	100	0	0	2.00	2.00	2.00
Total TCDF	2	100	0	0	1.33	1.33	1.33
1,2,3-Trichlorobenzene	2	0	0	0	.50	.50	.50
Total H6CDF	2	0	0	0	1.00	1.00	1.00

NOTE: (1) Concentration Ratio = Concentration divided by Regulation Method Detection Limit

Table 2.7
Detection Frequencies and Concentration Ratios For Candidate Parameters Monitored Quarterly and Semi-Annually Process Effluent from Esso Petroleum Canada (Nanticoke)

Parameter	Number of Observations	Frequency of Detection (%)			Concentration Ratios (1)		
		>RMDL	>2RMDL	>5RMDL	Minimum	Maximum	Average
TOC	19	95	11	0	.96	2.26	1.37
Nitrate+Nitrite	12	100	100	75	3.48	17.64	8.82
COD	12	100	92	8	1.10	5.70	3.06
Total Kjeldahl nitrogen	12	100	92	0	1.88	3.26	2.45
Zinc	12	100	83	0	1.40	4.00	2.70
Arsenic	12	100	67	0	1.00	3.40	2.25
Aluminum	12	92	92	42	.67	8.00	4.44
Molybdenum	12	92	75	0	.24	2.00	1.69
Methylene chloride	12	58	58	25	.25	25.38	4.57
Selenium	12	58	0	0	.60	1.60	1.10
Chloroform	12	50	42	8	.51	8.00	2.11
Chromium (hexavalent)	12	50	33	0	.31	3.10	1.30
1,2-Dichloroethane	12	50	0	0	.49	1.02	.76
Mercury	12	50	0	0	.50	1.50	.81
Chloromethane	12	25	8	0	.10	2.01	.61
Copper	12	17	0	0	.50	1.00	.66
1,2-Dichloropropane	12	0	0	0	.22	.60	.41
2,3,4,5-Tetrachlorophenol	12	0	0	0	.10	1.00	.32
2,3,4-Trichlorophenol	12	0	0	0	.10	.83	.28
Bromomethane	12	0	0	0	.22	.65	.44
Cadmium	12	0	0	0	.10	.30	.12
Chromium	12	0	0	0	.44	.50	.45
Naphthalene	12	0	0	0	.19	.25	.23
Pentachlorophenol	12	0	0	0	.14	.77	.30
Pyrene	12	0	0	0	.25	.75	.39
Vanadium	12	0	0	0	.16	.30	.18
Cyanide Total	9	56	56	0	.60	4.60	2.40
Octachlorodibenzo-p-dioxin	1	100	100	0	3.00	3.00	3.00
Octachlorodibenzofuran	1	100	100	0	2.67	2.67	2.67
Total H6CDF	1	100	100	0	2.50	2.50	2.50
Total TCDF	1	100	100	0	2.67	2.67	2.67
2,3,7,8 TCDD	1	100	0	0	1.50	1.50	1.50
Total H6CDD	1	100	0	0	2.00	2.00	2.00
Total H7CDD	1	100	0	0	2.00	2.00	2.00
Total H7CDF	1	100	0	0	1.67	1.67	1.67
Total PCDF	1	100	0	0	1.33	1.33	1.33
Total TCDD	1	100	0	0	1.50	1.50	1.50
1,2,3-Trichlorobenzene	1	0	0	0	.20	.20	.20
Total PCDD	1	0	0	0	1.00	1.00	1.00

NOTE: (1) Concentration Ratio = Concentration divided by Regulation Method Detection Limit

Table 3.1
Detection Frequencies and Concentration Ratios For Candidate Parameters - Travelling Blanks from Esso Petroleum Canada (Sarnia)

Parameter	Number of Observations	Frequency of Detection >RMDL (%)	Concentration Ratios (1) Minimum	Maximum	Average
o-Xylene	15	13	.40	32.60	2.99
m-Xylene and p-Xylene	15	13	.18	32.55	2.58
Toluene	15	33	.40	8.20	1.73
DOC	15	33	1.00	6.00	1.72
2,3,4-Trichlorophenol	4	100	1.33	1.33	1.33
Benzene	15	20	.20	6.00	1.33
Oil and grease	13	15	.50	5.00	1.30
2,3,4,5-Tetrachlorophenol	4	100	1.25	1.25	1.25
Naphthalene	4	100	1.25	1.25	1.25
Pyrene	4	100	1.25	1.25	1.25
Aluminum	4	25	1.00	1.77	1.19
Cadmium	4	0	1.00	1.00	1.00
Chromium	4	0	1.00	1.00	1.00
Copper	4	0	1.00	1.00	1.00
Cyanide Total	4	0	1.00	1.00	1.00
Mercury	4	0	1.00	1.00	1.00
Molybdenum	4	0	1.00	1.00	1.00
Total suspended solids	1	0	1.00	1.00	1.00
Zinc	4	0	1.00	1.00	1.00
Phenolics (4AAP)	13	8	.10	2.00	.93
Total phosphorus	15	20	.80	1.50	.91
Sulphide	16	0	.50	1.00	.90
Pentachlorophenol	4	0	.77	.77	.77
Vanadium	4	0	.67	.67	.67
COD	3	0	.50	.90	.63
Methylene chloride	4	25	.38	1.08	.58
Bromomethane	4	0	.54	.54	.54
Chloromethane	4	0	.54	.54	.54
VSS	1	0	.50	.50	.50
Ammonia plus Ammonium	15	0	.10	.80	.45
Arsenic	4	0	.40	.40	.40
Selenium	4	0	.20	.40	.35
Chloroform	4	0	.29	.29	.29
1,2-Dichloroethane	4	0	.25	.25	.25
1,2-Dichloropropane	4	0	.22	.22	.22
TOC	15	0	.10	.56	.21
Nitrate+Nitrite	4	0	.20	.20	.20
Total Kjeldahl nitrogen	4	0	.20	.20	.20

NOTE: (1) Concentration Ratio = Concentration divided by Regulation Method Detection Limit

Table 3.2
Detection Frequencies and Concentration Ratios For Candidate Parameters - Travelling Blanks from Petro-Canada Inc., Lake Ontario Refinery - Mississauga

Parameter	Number of Observations	Frequency of Detection >RMDL (%)	Concentration Ratio (1)		
			Minimum	Maximum	Average
DOC	14	50	.20	9.96	3.24
Methylene chloride	4	25	.31	10.42	2.84
Cadmium	4	75	.50	3.00	2.38
1,2-Dichloroethane	4	75	1.00	2.62	2.22
Aluminum	4	75	.20	5.33	2.00
Chloroform	4	50	.71	4.16	1.76
Zinc	14	36	.70	8.90	1.60
Pentachlorophenol	4	50	1.00	1.15	1.08
Bromomethane	4	25	1.00	1.16	1.04
2,3,4,5-Tetrachlorophenol	4	0	1.00	1.00	1.00
Mercury	4	25	1.00	1.00	1.00
Phenolics (4AAP)	14	0	1.00	1.00	1.00
Chloromethane	4	0	.95	.95	.95
2,3,4-Trichlorophenol	4	0	.83	.83	.83
COD	5	0	.80	.80	.80
Copper	4	0	.80	.80	.80
Naphthalene	4	50	.44	1.12	.78
Pyrene	4	0	.50	1.00	.75
Oil and grease	11	0	.71	.80	.73
Total phosphorus	14	7	.60	1.00	.65
Sulphide	12	8	.50	1.50	.60
1,2-Dichloropropane	4	0	.56	.56	.56
TOC	14	7	.14	1.26	.46
Chromium	14	0	.10	.40	.34
Benzene	13	0	.20	.80	.25
Selenium	4	0	.10	.28	.24
o-Xylene	13	0	.20	.60	.23
Toluene	13	0	.20	.40	.22
Cyanide Total	5	0	.20	.20	.20
Molybdenum	4	0	.20	.20	.20
Total Kjeldahl nitrogen	5	0	.20	.20	.20
Ammonia plus Ammonium	12	0	.16	.20	.17
Vanadium	4	0	.17	.17	.17
m-Xylene and p-Xylene	13	0	.10	.45	.13
Arsenic	4	0	.10	.16	.12
Nitrate+Nitrite	5	0	.10	.10	.10

NOTE: (1) Concentration Ratio = Concentration divided by Regulation Method Detection Limit

Table 3.3
Detection Frequencies and Concentration Ratios For Candidate Parameters - Travelling Blanks from Petro-Canada Inc., Lake Ontario Refinery - Oakville Plant

Parameter	Number of Observations	Frequency of Detection >RMDL (%)	Concentration Ratios (1)		
			Minimum	Maximum	Average
Zinc	15	67	.10	989.00	133.36
Cadmium	4	75	.50	137.00	35.88
Ammonia plus Ammonium	7	86	.60	4.00	3.28
1,2-Dichloroethane	4	50	1.00	2.62	1.81
Bromomethane	4	75	1.00	1.16	1.12
Pentachlorophenol	4	50	1.00	1.15	1.08
2,3,4,5-Tetrachlorophenol	4	0	1.00	1.00	1.00
Mercury	4	0	1.00	1.00	1.00
Sulphide	7	0	1.00	1.00	1.00
Chloromethane	4	0	.95	.95	.95
2,3,4-Trichlorophenol	4	0	.83	.83	.83
COD	4	0	.80	.80	.80
Copper	4	0	.80	.80	.80
Naphthalene	4	50	.44	1.12	.78
Pyrene	4	0	.50	1.00	.75
Chloroform	4	0	.71	.71	.71
Total phosphorus	12	8	.60	1.20	.67
Aluminum	4	25	.20	1.33	.59
1,2-Dichloropropane	4	0	.56	.56	.56
Phenolics (4AAP)	7	0	.25	.50	.46
DOC	12	0	.20	.84	.44
Oil and grease	8	0	.35	1.00	.43
Methylene chloride	4	0	.31	.31	.31
Chromium	15	0	.10	.40	.26
Benzene	13	0	.20	.80	.25
Toluene	13	0	.20	.40	.25
o-Xylene	13	0	.20	.60	.23
Molybdenum	4	0	.20	.25	.21
Cyanide Total	4	0	.20	.20	.20
Selenium	4	0	.10	.28	.19
Total Kjeldahl nitrogen	4	0	.10	.22	.18
Vanadium	4	0	.17	.17	.17
TOC	12	0	.14	.24	.16
m-Xylene and p-Xylene	13	0	.10	.45	.13
Arsenic	4	0	.10	.16	.12
Nitrate+Nitrite	4	0	.10	.10	.10

NOTE: (1) Concentration Ratio = Concentration divided by Regulation Method Detection Limit

Table 3.4
Detection Frequencies and Concentration Ratios For Candidate - Travelling Blanks from Novacor (Corunna)

Parameter	Number of Observations	Frequency of Detection >RMDL (%)	Concentration Ratios (1)		
			Minimum	Maximum	Average
Total PCDF	1	100	20.00	20.00	20.00
Total TCDF	1	100	20.00	20.00	20.00
Total PCDD	1	100	15.00	15.00	15.00
2,3,7,8 TCDD	1	100	10.00	10.00	10.00
Total H6CDF	1	100	10.00	10.00	10.00
Total TCDD	1	100	10.00	10.00	10.00
Octachlorodibenzofuran	1	100	6.67	6.67	6.67
Octachlorodibenzo-p-dioxin	1	100	3.33	3.33	3.33
Total H6CDD	1	100	3.33	3.33	3.33
Total H7CDD	1	100	3.33	3.33	3.33
Total H7CDF	1	100	3.33	3.33	3.33
Aluminum	4	75	.33	3.33	2.12
Methylene chloride	4	25	.23	6.23	1.73
1,2,3-Trichlorobenzene	1	100	1.50	1.50	1.50
Sulphide	15	33	.95	2.50	1.20
Zinc	14	36	.10	4.00	1.14
DOC	17	12	.63	4.00	1.13
Phenolics (4AAP)	17	6	1.00	1.50	1.03
2,3,4,5-Tetrachlorophenol	4	0	1.00	1.00	1.00
Cadmium	4	0	1.00	1.00	1.00
Oil and grease	16	6	.96	1.00	.99
o-Xylene	17	0	.84	.84	.84
2,3,4-Trichlorophenol	4	0	.83	.83	.83
Pentachlorophenol	4	0	.77	.85	.83
Total suspended solids	3	0	.83	.83	.83
Toluene	17	0	.78	.78	.78
Pyrene	4	0	.75	.75	.75
COD	4	0	.62	.80	.67
Chromium	14	14	.10	1.00	.67
Bromomethane	4	0	.65	.65	.65
Chloromethane	4	0	.62	.62	.62
Arsenic	3	0	.60	.60	.60
Selenium	3	0	.60	.60	.60
Chloroform	4	0	.57	.57	.57
Total Kjeldahl nitrogen	4	0	.45	.90	.57
1,2-Dichloropropane	4	0	.56	.56	.56
1,2-Dichloroethane	4	0	.50	.50	.50
Benzene	17	0	.48	.48	.48
m-Xylene and p-Xylene	17	0	.44	.44	.44
Ammonia plus Ammonium	14	0	.10	.64	.43
TOC	16	0	.13	.50	.43
Cyanide Total	4	0	.20	.40	.40
Total phosphorus	15	0	.13	.40	.35
VSS	3	0	.35	.35	.35
Copper	4	0	.30	.30	.30
Molybdenum	4	0	.30	.30	.30
Mercury	3	0	.19	.19	.19
Naphthalene	4	0	.19	.19	.19
Nitrate+Nitrite	3	0	.10	.10	.10
Vanadium	4	0	.10	.10	.10

NOTE: (1) Concentration Ratio = Concentration divided by Regulation Method Detection Limit

Table 3.5
Detection Frequencies and Concentration Ratios For Candidate Parameters - Travelling Blanks from Shell Canada Products Limited (Sarnia)

Parameter	Number of Observations	Frequency of Detection >RMDL (%)	Concentration Ratios (1) Minimum	Maximum	Average
Zinc	17	41	.10	40.00	3.38
DOC	12	50	.96	8.00	3.23
Oil and grease	12	67	.98	7.00	2.35
Aluminum	4	50	.33	3.33	1.91
Toluene	16	13	.78	11.12	1.60
Methylene chloride	4	25	.23	5.15	1.46
Benzene	16	6	.48	4.99	1.12
2,3,4,5-Tetrachlorophenol	4	0	1.00	1.00	1.00
Cadmium	4	0	1.00	1.00	1.00
Phenolics (4AAP)	12	8	.55	1.50	1.00
Sulphide	10	0	1.00	1.00	1.00
Chromium	17	12	.10	2.50	.91
2,3,4-Trichlorophenol	4	0	.83	.83	.83
Pentachlorophenol	4	0	.77	.85	.83
m-Xylene and p-Xylene	16	6	.44	5.00	.81
Ammonia plus Ammonium	13	0	.16	.80	.75
Pyrene	4	0	.75	.75	.75
o-Xylene	16	0	.70	.84	.73
COD	4	0	.62	.80	.70
TOC	12	0	.60	.80	.70
Total Kjeldahl nitrogen	4	0	.45	.90	.68
Bromomethane	4	0	.65	.65	.65
Total phosphorus	12	8	.10	2.00	.63
Chloromethane	4	0	.62	.62	.62
Chloroform	4	0	.57	.57	.57
1,2-Dichloropropane	4	0	.56	.56	.56
1,2-Dichloroethane	4	0	.50	.50	.50
Arsenic	4	0	.10	.60	.48
Selenium	4	0	.10	.60	.48
Cyanide Total	4	0	.40	.40	.40
Copper	4	0	.30	.30	.30
Molybdenum	4	0	.30	.30	.30
Mercury	4	0	.19	.19	.19
Naphthalene	4	0	.19	.19	.19
Nitrate+Nitrite	3	0	.10	.10	.10
Vanadium	4	0	.10	.10	.10

NOTE: (1) Concentration Ratio = Concentration divided by Regulation Method Detection Limit

Table 3.6
Detection Frequencies and Concentration Ratios For Candidate Parameters - Travelling Blanks from Suncor Inc. (Sarnia)

Parameter	Number of Observations	Frequency of Detection >RMDL (%)	Concentration Ratios (1)		
			Minimum	Maximum	Average
2,3,4-Trichlorophenol	4	100	1.33	1.33	1.33
2,3,4,5-Tetrachlorophenol	4	100	1.25	1.25	1.25
Naphthalene	4	100	1.25	1.25	1.25
Pyrene	4	100	1.25	1.25	1.25
Aluminum	4	0	1.00	1.00	1.00
Cadmium	4	0	1.00	1.00	1.00
Chromium	4	0	1.00	1.00	1.00
Copper	4	0	1.00	1.00	1.00
Cyanide Total	4	0	1.00	1.00	1.00
Mercury	4	0	1.00	1.00	1.00
Molybdenum	4	0	1.00	1.00	1.00
Zinc	4	0	1.00	1.00	1.00
Pentachlorophenol	4	0	.77	.77	.77
Ammonia plus Ammonium	12	0	.72	.88	.74
Benzene	15	7	.20	1.00	.73
Total Kjeldahl nitrogen	3	33	.20	1.60	.67
Vanadium	4	0	.67	.67	.67
Methylene chloride	4	25	.38	1.23	.62
o-Xylene	15	0	.40	.70	.62
DOC	13	0	.60	.60	.60
Phenolics (4AAP)	14	7	.50	1.00	.56
Bromomethane	4	0	.54	.54	.54
Chloromethane	4	0	.54	.54	.54
COD	2	0	.50	.50	.50
Sulphide	13	0	.50	.50	.50
Oil and grease	13	0	.40	.70	.49
Toluene	15	0	.40	.60	.44
Total phosphorus	14	0	.40	.50	.41
Arsenic	4	0	.40	.40	.40
Selenium	4	0	.40	.40	.40
m-Xylene and p-Xylene	15	0	.18	.41	.36
Chloroform	4	0	.29	.29	.29
1,2-Dichloroethane	4	0	.25	.25	.25
1,2-Dichloropropane	4	0	.22	.22	.22
Nitrate+Nitrite	3	0	.20	.20	.20
TOC	13	0	.14	.14	.14

NOTE: (1) Concentration Ratio = Concentration divided by Regulation Method Detection Limit

Table 3.7
Detection Frequencies and Concentration Ratios For Candidate Parameters - Travelling Blanks from Esso Petroleum Canada (Nanticoke)

Parameter	Number of Observations	Frequency of Detection >RMDL (%)	Concentration Ratios (1)		
			Minimum	Maximum	Average
Cyanide Total	4	25	.60	12.80	3.60
Methylene chloride	4	75	.25	5.85	3.52
Chloroform	4	50	.51	3.14	1.72
Chloromethane	4	25	.10	4.35	1.29
Aluminum	4	25	.53	3.33	1.23
Oil and grease	11	36	.97	2.20	1.14
Sulphide	11	36	.50	2.00	1.05
Phenolics (4AAP)	12	17	.10	3.50	1.01
Zinc	4	50	1.00	1.02	1.01
Total phosphorus	13	15	.10	4.80	1.00
Bromomethane	4	25	.22	1.57	.77
1,2-Dichloroethane	4	50	.49	1.02	.76
Toluene	13	15	.30	2.60	.71
Benzene	13	8	.26	3.60	.69
Copper	4	0	.60	.64	.62
Chromium	4	25	.44	1.00	.58
Mercury	4	0	.56	.57	.56
COD	4	25	.10	1.10	.53
Arsenic	4	0	.49	.49	.49
DOC	13	23	.10	1.20	.45
1,2-Dichloropropane	4	0	.22	.60	.41
Pyrene	4	0	.25	.75	.39
o-Xylene	13	0	.10	.84	.39
2,3,4,5-Tetrachlorophenol	4	0	.10	1.00	.32
Chromium (hexavalent)	4	0	.30	.31	.31
Pentachlorophenol	4	0	.14	.77	.30
2,3,4-Trichlorophenol	4	0	.10	.83	.28
Molybdenum	4	0	.24	.25	.25
Naphthalene	4	0	.19	.25	.23
m-Xylene and p-Xylene	13	0	.10	.44	.21
Selenium	4	0	.19	.19	.19
Ammonia plus Ammonium	12	0	.16	.24	.17
Vanadium	4	0	.16	.17	.16
Cadmium	4	0	.10	.10	.10
Nitrate+Nitrite	4	0	.10	.10	.10
TOC	8	0	.10	.10	.10
Total Kjeldahl nitrogen	4	0	.10	.10	.10

NOTE: (1) Concentration Ratio = Concentration divided by Regulation Method Detection Limit

Table 4.1
Range of Recoveries and Ratio of Spiked Quantity to Regulation Method Detection Limit for Candidate Parameters (1) in Process Effluent from Esso Petroleum Canada (Sarnia)

ATG	Parameter	Number of Observations	Recovery (2) (%) Minimum	Maximum	Average	SPIKE/RMDL (3)
16	1,2-Dichloroethane	4	94	148	117	6.25
	1,2-Dichloropropane	4	102	136	114	5.56
	Chloroform	4	92	140	111	7.14
	Methylene chloride	4	88	136	109	3.85
	Chloromethane	4	78	122	105	2.70
	Bromomethane	4	76	114	99	2.70
17	Benzene	15	80	136	102	24.73
	Toluene	15	57	124	97	24.73
	m-Xylene and p-Xylene	15	57	136	97	9.89
	o-Xylene	15	3	112	84	20.47
19	Pyrene	4	42	152	96	54.69
	Naphthalene	4	67	128	88	13.67
20	2,3,4-Trichlorophenol	3	80	122	105	42.00
	Pentachlorophenol	4	77	95	86	19.23
	2,3,4,5-Tetrachlorophenol	3	46	83	70	63.25

NOTE: (1) - Only those parameters for which travelling spikes were required are presented. Data for other parameters were also provided by some dischargers and are included in the table.

(2) - Recovery = Actual value divided by expected value X 100%

(3) - SPIKE/RMDL = Expected value of the spiked sample divided by Regulation Method Detection Limit

Table 4.2
Range of Recoveries and Ratio of Spiked Quantity to Regulation Method Detection Limit for Candidate Parameters (1) in Process Effluent from Petro-Canada Inc., Lake Ontario Refinery - Mississauga

ATG	Parameter	Number of Observations	Recovery (2) (%)			SPIKE/RMDL (3)
			Minimum	Maximum	Average	
16	Methylene chloride	4	71	957	308	3.08
	Bromomethane	4	51	249	122	5.41
	Chloroform	4	80	125	100	5.71
	1,2-Dichloropropane	4	64	123	91	4.44
	1,2-Dichloroethane	4	67	120	86	5.00
	Chloromethane	4	54	83	73	5.41
17	Benzene	14	75	133	96	6.04
	Toluene	14	71	115	95	5.74
	o-Xylene	14	72	112	90	5.68
	m-Xylene and p-Xylene	14	66	108	87	3.02
19	Pyrene	4	88	103	97	20.00
	Naphthalene	4	73	100	86	5.00
20	2,3,4,5-Tetrachlorophenol	4	23	227	119	13.10
	Pentachlorophenol	4	79	141	106	7.49
	2,3,4-Trichlorophenol	4	77	98	89	13.87

NOTE: (1) - Only those parameters for which travelling spikes were required are presented. Data for other parameters were also provided by some dischargers and are included in the table.

(2) - Recovery = Actual value divided by expected value X 100%

(3) - SPIKE/RMDL = Expected value of the spiked sample divided by Regulation Method Detection Limit

Table 4.3
Range of Recoveries and Ratio of Spiked Quantity to Regulation Method Detection Limit for Candidate Parameters [(1)] in Process Effluent from Petro-Canada Inc., Lake Ontario Refinery - Oakville Plant

ATG	Parameter	Number of Observations	Recovery (2) (%) Minimum	Maximum	Average	SPIKE/RMDL (3)
16	1,2-Dichloropropane	4	84	182	115	3.33
	Methylene chloride	4	94	114	104	2.31
	Chloroform	4	73	121	98	4.29
	1,2-Dichloroethane	4	74	99	87	3.75
	Bromomethane	4	51	97	77	5.41
	Chloromethane	4	56	91	73	5.41
17	Benzene	13	83	133	99	5.74
	Toluene	13	85	115	96	5.46
	m-Xylene and p-Xylene	13	77	108	90	2.91
	o-Xylene	13	72	99	90	5.50
19	Pyrene	4	72	108	91	20.00
	Naphthalene	4	75	103	87	5.00
20	2,3,4,5-Tetrachlorophenol	4	43	194	117	13.10
	Pentachlorophenol	4	78	138	112	7.49
	2,3,4-Trichlorophenol	4	79	144	98	13.87

NOTE: (1) - Only those parameters for which travelling spikes were required are presented. Data for other parameters were also provided by some dischargers and are included in the table.

(2) - Recovery = Actual value divided by expected value X 100%

(3) - SPIKE/RMDL = Expected value of the spiked sample divided by Regulation Method Detection Limit

Table 4.4
Range of Recoveries and Ratio of Spiked Quantity to Regulation Method Detection Limit for Candidate Parameters [1] in Process Effluent from Novacor (Corunna)

ATG	Parameter	Number of Observations	Recovery (%)			SPIKE/RMDL (3)
			Minimum	Maximum	Average	
16	Chloromethane	4	95	125	108	5.41
	1,2-Dichloropropane	4	95	110	103	22.22
	1,2-Dichloroethane	4	85	110	98	25.00
	Bromomethane	4	90	105	96	5.41
	Chloroform	4	85	100	95	28.57
	Methylene chloride	4	70	100	86	15.39
17	m-Xylene and p-Xylene	15	68	125	99	36.36
	o-Xylene	15	75	110	99	40.00
	Benzene	15	65	150	97	40.00
	Toluene	15	65	105	93	40.00
19	Pyrene	4	67	80	73	50.00
	Naphthalene	4	55	74	65	12.50
20	Pentachlorophenol	4	80	135	100	15.39
	2,3,4,5-Tetrachlorophenol	4	80	98	88	75.00
	2,3,4-Trichlorophenol	4	75	90	82	33.33
23	1,2,3-Trichlorobenzene	1	160	160	160	10.00
24	Octachlorodibenzo-p-dioxin	1	74	74	74	333.33
	Octachlorodibenzofuran	1	57	57	57	333.33
	Total H7CDD	1	53	53	53	333.33
	Total H7CDF	1	48	48	48	333.33
	Total H6CDD	1	41	41	41	333.33
	Total TCDF	1	40	40	40	666.67
	Total H6CDF	1	39	39	39	500.00
	Total PCDF	1	39	39	39	666.67
	Total PCDD	1	38	38	38	500.00
	Total TCDD	1	27	27	27	500.00

NOTE: (1) - Only those parameters for which travelling spikes were required are presented. Data for other parameters were also provided by some dischargers and are included in the table.

(2) - Recovery = Actual value divided by expected value X 100%

(3) - SPIKE/RMDL = Expected value of the spiked sample divided by Regulation Method Detection Limit

Table 4.5

Range of Recoveries and Ratio of Spiked Quantity to Regulation Method Detection Limit for Candidate Parameters (1) in Process Effluent from Shell Canada Products Limited (Sarnia)

ATG	Parameter	Number of Observations	Recovery (2) (%) Minimum	Maximum	Average	SPIKE/RMDL (3)
16	Chloromethane	4	95	120	108	5.41
	1,2-Dichloroethane	4	100	115	106	25.00
	Chloroform	4	100	110	104	28.57
	Methylene chloride	4	95	115	101	15.39
	Bromomethane	4	90	105	98	5.41
	1,2-Dichloropropane	4	70	105	94	22.22
17	Toluene	15	8	448	95	24.33
	o-Xylene	15	16	153	68	13.89
	m-Xylene and p-Xylene	15	13	131	64	14.32
	Benzene	15	6	115	54	24.48
19	Pyrene	4	70	93	78	50.00
	Naphthalene	4	60	89	75	12.50
20	Pentachlorophenol	4	95	135	108	15.39
	2,3,4,5-Tetrachlorophenol	4	90	99	94	75.00
	2,3,4-Trichlorophenol	4	75	102	91	33.33

NOTE: (1) - Only those parameters for which travelling spikes were required are presented. Data for other parameters were also provided by some dischargers and are included in the table.

(2) - Recovery = Actual value divided by expected value X 100%

(3) - SPIKE/RMDL = Expected value of the spiked sample divided by Regulation Method Detection Limit

Table 4.6
Range of Recoveries and Ratio of Spiked Quantity to Regulation Method Detection Limit for Candidate Parameters (1) in Process Effluent from Suncor Inc. (Sarnia)

ATG	Parameter	Number of Observations	Recovery (2) (%) Minimum	Maximum	Average	SPIKE/RMDL (3)
16	Methylene chloride	4	92	142	113	3.85
	1,2-Dichloroethane	4	100	122	107	6.25
	1,2-Dichloropropane	4	98	110	103	5.56
	Chloroform	4	94	112	103	7.14
	Chloromethane	4	93	106	99	2.70
	Bromomethane	4	78	111	91	2.70
17	Benzene	15	84	113	99	24.26
	o-Xylene	15	80	114	97	26.38
	Toluene	15	73	118	96	24.26
	m-Xylene and p-Xylene	15	53	112	93	20.44
19	Pyrene	4	61	94	82	46.88
	Naphthalene	4	64	86	74	11.72
20	2,3,4-Trichlorophenol	4	64	112	82	41.92
	Pentachlorophenol	4	56	97	78	19.23
	2,3,4,5-Tetrachlorophenol	4	66	90	74	63.06

NOTE: (1) - Only those parameters for which travelling spikes were required are presented. Data for other parameters were also provided by some dischargers and are included in the table.

(2) - Recovery = Actual value divided by expected value X 100%

(3) - SPIKE/RMDL = Expected value of the spiked sample divided by Regulation Method Detection Limit

Table 4.7
Range of Recoveries and Ratio of Spiked Quantity to Regulation Method Detection Limit for Candidate Parameters (1) in Process Effluent from Esso Petroleum Canada (Nanticoke)

ATG	Parameter	Number of Observations	Recovery (2) (%)			SPIKE/RMDL (3)
			Minimum	Maximum	Average	
16	Chloromethane	3	110	945	448	2.07
	Methylene chloride	3	100	445	255	5.90
	Bromomethane	3	100	360	242	2.07
	Chloroform	3	67	300	157	10.95
	1,2-Dichloroethane	3	41	95	67	9.58
	1,2-Dichloropropane	3	14	105	65	8.59
17	m-Xylene and p-Xylene	10	52	182	91	7.38
	Toluene	11	58	107	85	11.73
	Benzene	11	32	104	80	11.21
	o-Xylene	12	21	105	77	10.83
19	Pyrene	3	50	102	82	10.00
	Naphthalene	3	53	96	81	2.50
20	Pentachlorophenol	4	4	199	81	25.83
	2,3,4-Trichlorophenol	3	48	88	73	71.50
	2,3,4,5-Tetrachlorophenol	3	12	105	55	127.83

NOTE: (1) - Only those parameters for which travelling spikes were required are presented. Data for other parameters were also provided by some dischargers and are included in the table.

(2) - Recovery = Actual value divided by expected value X 100%

(3) - SPIKE/RMDL = Expected value of the spiked sample divided by Regulation Method Detection Limit

Table 5.1
Average Absolute Difference Ratio Between
Process and Duplicate Data for
Candidate Parameters
Esso Petroleum Canada (Sarnia)

Parameter	Number of Observations	Difference Ratio (1) Minimum	Maximum	Average
COD	2	.10	4.10	2.10
m-Xylene and p-Xylene	13	.00	15.09	1.50
DOC	13	.00	2.80	1.39
Toluene	13	.00	11.40	1.39
Benzene	13	.00	6.40	1.14
Total phosphorus	13	.20	2.70	1.11
Sulphide	14	.00	9.00	.89
Cyanide Total	2	.40	.60	.50
o-Xylene	13	.00	3.20	.47
Methylene chloride	3	.00	1.00	.46
Total Kjeldahl nitrogen	1	.40	.40	.40
Total suspended solids	11	.06	1.18	.39
Vanadium	2	.00	.57	.28
Selenium	2	.00	.40	.20
Bromomethane	3	.00	.54	.18
Chloromethane	3	.00	.54	.18
TOC	13	.00	.60	.18
Zinc	2	.00	.30	.15
VSS	11	.00	.59	.14
Phenolics (4AAP)	12	.00	.50	.13
Arsenic	2	.00	.20	.10
Chloroform	3	.00	.29	.10
Nitrate+Nitrite	2	.04	.16	.10
1,2-Dichloroethane	3	.00	.25	.08
Ammonia plus Ammonium	13	.00	.60	.08
1,2-Dichloropropane	3	.00	.22	.07
Oil and grease	12	.00	.30	.07
Aluminum	2	.00	.07	.03
2,3,4,5-Tetrachlorophenol	2	.00	.00	.00
2,3,4-Trichlorophenol	2	.00	.00	.00
Cadmium	2	.00	.00	.00
Chromium	2	.00	.00	.00
Copper	2	.00	.00	.00
Mercury	2	.00	.00	.00
Molybdenum	2	.00	.00	.00
Naphthalene	2	.00	.00	.00
Pentachlorophenol	2	.00	.00	.00
Pyrene	2	.00	.00	.00

NOTE: (1) - Absolute Difference Concentration Ratio = Absolute value of the difference in concentration between Process Effluent and Duplicate Samples divided by Regulation Method Detection Limit

Table 5.2
Average Absolute Difference Ratio Between Process and Duplicate Data for Candidate Parameters
Petro-Canada Inc., Lake Ontario Refinery - Mississauga

Parameter	Number of Observations	Difference Ratio (1) Minimum	Maximum	Average
Ammonia plus Ammonium	11	.00	100.00	11.03
Aluminum	4	.33	9.93	2.98
DOC	13	.00	7.40	2.84
COD	4	.00	7.20	2.53
Methylene chloride	4	.00	10.12	2.53
Zinc	10	.10	11.70	2.43
Sulphide	12	.00	10.85	1.99
Chloroform	4	.33	3.44	1.46
Bromomethane	4	.00	2.35	.59
Cadmium	3	.00	1.50	.50
1,2-Dichloroethane	4	.00	1.87	.47
Chromium	11	.00	2.50	.42
TOC	13	.00	.82	.40
Total suspended solids	10	.00	1.28	.39
Total Kjeldahl nitrogen	4	.08	.80	.37
Oil and grease	11	.00	1.00	.30
Phenolics (4AAP)	14	.00	.50	.24
Total phosphorus	13	.00	.90	.22
VSS	12	.00	.67	.21
Molybdenum	4	.00	.35	.15
Vanadium	4	.00	.33	.13
Mercury	4	.00	.50	.12
Chloromethane	4	.00	.46	.11
Arsenic	3	.04	.14	.10
Cyanide Total	4	.00	.40	.10
Nitrate+Nitrite	4	.00	.21	.09
o-Xylene	13	.00	.80	.09
Benzene	13	.00	.40	.05
Toluene	13	.00	.40	.04
Copper	4	.00	.10	.03
m-Xylene and p-Xylene	13	.00	.26	.02
Selenium	3	.00	.02	.01
1,2-Dichloropropane	4	.00	.00	.00
2,3,4,5-Tetrachlorophenol	3	.00	.00	.00
2,3,4-Trichlorophenol	3	.00	.00	.00
Naphthalene	3	.00	.00	.00
Pentachlorophenol	3	.00	.00	.00
Pyrene	3	.00	.00	.00

NOTE: (1) - Absolute Difference Concentration Ratio = Absolute value of the difference in concentration divided by Regulation Method Detection Limit

Table 5.3
Average Absolute Difference Ratio Between Process and Duplicate Data for Candidate Parameters
Petro-Canada Inc., Lake Ontario Refinery - Oakville Plant

Parameter	Number of Observations	Difference Ratio (1) Minimum	Maximum	Average
Aluminum	4	1.00	12.00	5.16
Total Kjeldahl nitrogen	4	.24	3.60	1.42
Arsenic	4	.12	3.20	1.28
1,2-Dichloroethane	3	.00	1.62	1.08
DOC	13	.00	2.00	1.03
Ammonia plus Ammonium	11	.00	3.60	.91
Phenolics (4AAP)	20	.00	3.00	.88
Chloromethane	3	.00	2.47	.82
Cadmium	4	.00	2.50	.75
Zinc	10	.00	3.00	.70
Chromium	10	.00	2.00	.69
Selenium	4	.00	1.28	.67
Total phosphorus	13	.00	2.30	.65
Mercury	4	.00	1.00	.50
Molybdenum	4	.15	.70	.43
Sulphide	7	.00	2.50	.43
Copper	4	.00	.80	.40
COD	4	.00	1.20	.38
Naphthalene	3	.00	1.09	.36
o-Xylene	13	.00	3.72	.31
Oil and grease	14	.00	1.20	.26
Total suspended solids	7	.00	.60	.23
Cyanide Total	4	.00	.40	.20
Bromomethane	3	.00	.54	.18
TOC	13	.00	.52	.18
Toluene	13	.00	1.80	.17
VSS	13	.00	.30	.11
1,2-Dichloropropane	3	.00	.23	.08
Vanadium	4	.00	.17	.08
Nitrate+Nitrite	4	.00	.14	.05
Benzene	13	.00	.20	.02
m-Xylene and p-Xylene	13	.00	.25	.02
2,3,4,5-Tetrachlorophenol	3	.00	.00	.00
2,3,4-Trichlorophenol	3	.00	.00	.00
Chloroform	3	.00	.00	.00
Methylene chloride	3	.00	.00	.00
Pentachlorophenol	3	.00	.00	.00
Pyrene	3	.00	.00	.00

NOTE: (1) - Absolute Difference Concentration Ratio = Absolute value of the difference in concentration between Process Effluent and Duplicate Samples divided by Regulation Method Detection Limit

Table 5.4
Average Absolute Difference Ratio Between Process and Duplicate Data for Candidate Parameters
Novacor (Corunna)

Parameter	Number of Observations	Difference Ratio (1) Minimum	Maximum	Average
Aluminum	4	.67	18.00	6.17
DOC	17	.00	14.00	2.82
Cadmium	4	.00	9.50	2.38
Sulphide	14	.00	14.00	2.35
COD	4	.00	3.90	2.18
Zinc	15	.00	8.00	2.00
Nitrate+Nitrite	4	.00	4.40	1.20
Phenolics (4AAP)	16	.00	10.00	.78
Chromium	14	.00	2.50	.77
Oil and grease	16	.00	4.00	.50
Cyanide Total	4	.00	1.60	.45
Total phosphorus	16	.00	5.80	.42
Copper	3	.00	.90	.37
Mercury	4	.00	1.11	.28
Total suspended solids	15	.00	.60	.28
TOC	16	.00	1.00	.25
Total Kjeldahl nitrogen	4	.00	.80	.25
Arsenic	4	.00	.40	.20
Ammonia plus Ammonium	16	.00	1.04	.16
VSS	16	.00	.50	.13
Chloroform	4	.00	.17	.11
Methylene chloride	4	.00	.31	.08
o-Xylene	15	.00	.84	.06
Toluene	15	.00	.78	.05
Benzene	15	.00	.48	.03
m-Xylene and p-Xylene	15	.00	.44	.03
1,2,3-Trichlorobenzene	1	.00	.00	.00
1,2-Dichloroethane	4	.00	.00	.00
1,2-Dichloropropane	4	.00	.00	.00
2,3,4,5-Tetrachlorophenol	4	.00	.00	.00
2,3,4-Trichlorophenol	4	.00	.00	.00
2,3,7,8 TCDD	1	.00	.00	.00
Bromomethane	4	.00	.00	.00
Chloromethane	4	.00	.00	.00
Molybdenum	4	.00	.00	.00
Naphthalene	4	.00	.00	.00
Octachlorodibenzo-p-dioxin	1	.00	.00	.00
Octachlorodibenzofuran	1	.00	.00	.00
Pentachlorophenol	4	.00	.00	.00
Pyrene	4	.00	.00	.00
Selenium	4	.00	.00	.00
Total H6CDD	1	.00	.00	.00
Total H6CDF	1	.00	.00	.00
Total H7CDD	1	.00	.00	.00
Total H7CDF	1	.00	.00	.00
Total PCDD	1	.00	.00	.00
Total PCDF	1	.00	.00	.00
Total TCDD	1	.00	.00	.00
Total TCDF	1	.00	.00	.00
Vanadium	4	.00	.01	.00

NOTE: (1) - Absolute Difference Concentration Ratio = Absolute value of the difference in concentration between Process Effluent and Duplicate Samples divided by Regulation Method Detection Limit

Table 5.5
Average Absolute Difference Ratio Between Process and Duplicate Data for Candidate Parameters
Shell Canada Products Limited (Sarnia)

Parameter	Number of Observations	Difference Ratio (1)		
		Minimum	Maximum	Average
Aluminum	3	.00	47.33	16.44
DOC	12	.00	40.00	10.83
Total suspended solids	12	.60	29.60	5.58
Toluene	14	.00	28.90	4.75
Oil and grease	10	.00	10.00	2.53
Chromium	15	.00	28.00	2.09
m-Xylene and p-Xylene	14	.00	21.39	2.04
COD	3	.10	3.00	1.97
Total phosphorus	12	.00	11.50	1.90
VSS	12	.00	8.40	1.82
Zinc	15	.00	16.00	1.70
Benzene	14	.00	14.52	1.42
TOC	12	.00	2.80	.93
Total Kjeldahl nitrogen	3	.00	1.20	.67
o-Xylene	14	.00	3.17	.48
Arsenic	3	.00	1.00	.40
Phenolics (4AAP)	12	.00	1.50	.29
Cyanide Total	3	.00	.20	.13
Mercury	3	.00	.31	.10
Ammonia plus Ammonium	13	.00	.40	.08
Copper	3	.00	.20	.07
Vanadium	3	.00	.13	.06
Nitrate+Nitrite	2	.00	.04	.02
1,2-Dichloroethane	3	.00	.00	.00
1,2-Dichloropropane	3	.00	.00	.00
2,3,4,5-Tetrachlorophenol	3	.00	.00	.00
2,3,4-Trichlorophenol	3	.00	.00	.00
Bromomethane	3	.00	.00	.00
Cadmium	3	.00	.00	.00
Chloroform	3	.00	.00	.00
Chloromethane	3	.00	.00	.00
Methylene chloride	3	.00	.00	.00
Molybdenum	3	.00	.00	.00
Naphthalene	3	.00	.00	.00
Pentachlorophenol	3	.00	.00	.00
Pyrene	3	.00	.00	.00
Selenium	3	.00	.00	.00
Sulphide	9	.00	.00	.00

NOTE: (1) - Absolute Difference Concentration Ratio = Absolute value of the difference in concentration between Process Effluent and Duplicate Samples divided by Regulation Method Detection Limit

Table 5.6
Average Absolute Difference Ratio Between Process and Duplicate Data for Candidate Parameters
Suncor Inc. (Sarnia)

Parameter	Number of Observations	Difference Ratio (1)		
		Minimum	Maximum	Average
Nitrate+Nitrite	3	.16	10.84	4.07
Cyanide Total	4	.00	4.60	1.95
o-Xylene	15	.00	20.52	1.65
DOC	13	.00	8.00	1.54
Toluene	15	.00	10.34	.95
Zinc	4	.00	3.00	.75
Ammonia plus Ammonium	13	.00	3.88	.74
Methylene chloride	4	.00	1.92	.48
m-Xylene and p-Xylene	15	.00	6.23	.44
Aluminum	4	.00	.67	.42
Benzene	15	.00	5.60	.39
Oil and grease	13	.00	1.40	.37
Total phosphorus	13	.00	2.10	.35
Phenolics (4AAP)	15	.00	1.00	.33
Sulphide	12	.00	.50	.21
Selenium	4	.00	.60	.20
Total suspended solids	13	.00	.60	.20
COD	4	.00	.40	.15
TOC	13	.00	.80	.11
Arsenic	4	.00	.20	.10
VSS	13	.00	.40	.07
1,2-Dichloroethane	4	.00	.12	.03
Total Kjeldahl nitrogen	3	.00	.10	.03
1,2-Dichloropropane	4	.00	.00	.00
2,3,4,5-Tetrachlorophenol	4	.00	.00	.00
2,3,4-Trichlorophenol	4	.00	.00	.00
Bromomethane	4	.00	.00	.00
Cadmium	4	.00	.00	.00
Chloroform	4	.00	.00	.00
Chloromethane	4	.00	.00	.00
Chromium	4	.00	.00	.00
Copper	4	.00	.00	.00
Mercury	4	.00	.00	.00
Molybdenum	4	.00	.00	.00
Naphthalene	4	.00	.00	.00
Pentachlorophenol	4	.00	.00	.00
Pyrene	4	.00	.00	.00
Vanadium	4	.00	.00	.00

NOTE: (1) - Absolute Difference Concentration Ratio = Absolute value of the difference in concentration between Process Effluent and Duplicate Samples divided by Regulation Method Detection Limit

Table 5.7
Average Absolute Difference Ratio Between Process and Duplicate Data for Candidate Parameters Esso Petroleum Canada (Nanticoke)

Parameter	Number of Observations	Difference Ratio (1)		
		Minimum	Maximum	Average
DOC	5	.00	14.00	4.04
Phenolics (4AAP)	11	.00	9.50	1.72
Chloroform	4	.00	3.07	1.50
Cyanide Total	3	.00	2.60	1.07
Total phosphorus	9	.00	2.00	.93
Methylene chloride	4	.00	2.62	.74
Chloromethane	4	.00	1.75	.68
Oil and grease	13	.03	3.20	.57
Benzene	9	.00	2.58	.52
Total suspended solids	8	.04	2.96	.46
Sulphide	9	.00	1.50	.44
Total Kjeldahl nitrogen	2	.34	.38	.36
Molybdenum	2	.00	.50	.25
VSS	9	.00	1.40	.20
Copper	2	.00	.36	.18
COD	2	.10	.20	.15
Zinc	2	.00	.30	.15
Chromium	2	.00	.25	.13
Ammonia plus Ammonium	8	.00	.36	.12
TOC	5	.02	.34	.10
Toluene	9	.00	.94	.10
Nitrate+Nitrite	2	.00	.04	.02
Vanadium	2	.00	.03	.02
1,2-Dichloroethane	4	.00	.00	.00
1,2-Dichloropropane	4	.00	.00	.00
2,3,4,5-Tetrachlorophenol	3	.00	.00	.00
2,3,4-Trichlorophenol	3	.00	.00	.00
Aluminum	2	.00	.00	.00
Arsenic	2	.00	.00	.00
Bromomethane	4	.00	.00	.00
Cadmium	2	.00	.00	.00
Chromium (hexavalent)	2	.00	.00	.00
Mercury	2	.00	.00	.00
Naphthalene	3	.00	.00	.00
Pentachlorophenol	3	.00	.00	.00
Pyrene	3	.00	.00	.00
Selenium	2	.00	.00	.00
m-Xylene and p-Xylene	9	.00	.00	.00
o-Xylene	9	.00	.00	.00

NOTE: (1) - Absolute Difference Concentration Ratio = Absolute value of the difference in concentration between Process Effluent and Duplicate Samples divided by Regulation Method Detection Limit

Table 6.1
Method Blank Concentration Ratios for Candidate Parameters (1) in Process Effluent from Petro-Canada Inc., Lake Ontario Refinery - Mississauga

Parameter	Number of Observations	Difference Ratios (2)		
		Minimum	Maximum	Average
Benzene	12	.40	.80	.61
Toluene	12	.00	.20	.04
m-Xylene and p-Xylene	12	.00	.08	.01
o-Xylene	12	.00	.00	.00

Table 6.2
Method Blank Concentration Ratios for Candidate Parameters (1) in Process Effluent from Petro-Canada Inc., Lake Ontario Refinery - Oakville Plant

Parameter	Number of Observations	Difference Ratios (2)		
		Minimum	Maximum	Average
Benzene	12	.56	.84	.69
Toluene	12	.04	.20	.10
m-Xylene and p-Xylene	12	.00	.07	.02
o-Xylene	12	.00	.00	.00

Table 6.3
Method Blank Concentration Ratios for Candidate Parameters (1) in Process Effluent from Novacor (Corunna)

Parameter	Number of Observations	Difference Ratios (2)		
		Minimum	Maximum	Average
Methylene chloride	9	.69	3.69	1.99
Toluene	10	.00	3.22	1.69
Benzene	10	.00	1.46	.58
Chloroform	9	.00	.94	.50
m-Xylene and p-Xylene	21	.00	1.84	.37
1,2-Dichloroethane	9	.00	.00	.00
1,2-Dichloropropane	9	.00	.00	.00
2,3,4,5-Tetrachlorophenol	6	.00	.00	.00
2,3,4-Trichlorophenol	6	.00	.00	.00
Bromomethane	9	.00	.00	.00
Chloromethane	9	.00	.00	.00
Naphthalene	9	.00	.00	.00
Pentachlorophenol	6	.00	.00	.00
Pyrene	9	.00	.00	.00
o-Xylene	21	.00	.00	.00

NOTE: (1) - Only those parameters for which uncorrected data were submitted are presented.

(2) - Method Blank Concentration Ratio = Absolute value of the difference between corrected and uncorrected sample concentration divided by the RMDL.

Table 6.4
Method Blank Concentration Ratios for Candidate Parameters (1) in Process Effluent from Shell Canada Products Limited (Sarnia)

Parameter	Number of Observations	Difference Ratio (2) Minimum	Maximum	Average
Methylene chloride	9	1.85	3.54	2.61
Toluene	9	.00	4.22	1.90
m-Xylene and p-Xylene	9	.00	3.65	1.34
Benzene	9	.58	1.14	.81
1,2-Dichloroethane	9	.00	.00	.00
1,2-Dichloropropane	9	.00	.00	.00
2,3,4,5-Tetrachlorophenol	6	.00	.00	.00
2,3,4-Trichlorophenol	6	.00	.00	.00
Bromomethane	9	.00	.00	.00
Chloroform	9	.00	.00	.00
Chloromethane	9	.00	.00	.00
Naphthalene	8	.00	.00	.00
Pentachlorophenol	6	.00	.00	.00
Pyrene	8	.00	.00	.00
o-Xylene	9	.00	.00	.00

Table 6.5
Method Blank Concentration Ratios for Candidate Parameters (1) in Process Effluent from Suncor Inc. (Sarnia)

Parameter	Number of Observations	Difference Ratios (2) Minimum	Maximum	Average
Benzene	15	.52	26.32	4.77
Toluene	15	.54	27.54	4.77
o-Xylene	15	.00	32.92	4.75
m-Xylene and p-Xylene	15	.00	26.68	3.74

NOTE: Uncorrected data were not submitted by Esso Petroleum Canada (Sarnia) or by Esso Petroleum Canada (Nanticoke)

(1) - Only those parameters for which uncorrected data were submitted are presented.

(2) - Method Blank Concentration Ratio = Absolute value of the difference between corrected and uncorrected sample concentration divided by the RMDL.

APPENDIX E

DETAILED QA/QC ASSESSMENT OF INFREQUENT OCCURRENCE PARAMETERS

DETAILED QA/QC ASSESSMENT OF INFREQUENT OCCURRENCE PARAMETERS

ATG 9

Cadmium: RMDL = 2.0 µg/L

Candidate parameter for both Petro-Canada refineries. Both refineries share the same contract laboratory. Occurrence classification was frequent medium and the average effluent concentration ratio ranged from 2.2 to 3.1. Of all the data points for the 2 Petro-Canada refineries, there was only one actual detection (Mississauga). Eight of 12 data points were reported as 6.0 '<DL' for the Oakville refinery and 10 of 11 data points were reported the same way for the Mississauga refinery. The average effluent concentration ratio minus the average travelling blank ratio for the Oakville refinery is -33.7 (strong possibility of field contamination).

Although not candidate for Esso-Sarnia, it was classified as infrequent low and the ratio was 1.0 (at RMDL). All other refineries were classified as non-occurrences.

Conclusion: Data cannot be used to set quantitative limits, since there were no actual detections.

Chromium: RMDL = 20 µg/L

Candidate parameter for both Petro-Canada refineries, Shell and Novacor. All four sites monitored chromium thrice weekly, since these four refineries used chromium based additives in their cooling tower recirculating systems. The other refineries monitored chromium quarterly. Occurrence classifications and average effluent ratios are frequent high (6.3), frequent medium (4.4), frequent low (1.5), and frequent high (12.3) for the Mississauga, Oakville, Shell, and Novacor refineries respectively. After subtracting the average travelling blank ratios from the effluent ratios, the ratios become 6.0, 4.2, 0.6, and 11.6 respectively. The difference ratio between the duplicates and effluent data for Shell was 2.1 - shows high variability in reproducing the results.

Conclusion: Data may be used for setting limits with caution - high variability.

Copper: RMDL = 10 μg/L

"Unique parameter" - candidate parameter for Suncor refinery only. Occurrence classification was frequently low (FL) with an average concentration ratio of 2.1. The average effluent ratio drops to 1.1 after subtracting the average travelling blank ratio (possible field contamination). Of the 12 data points, 11 were reported as either 10 (4 records) or 10 '<DL'(7 records), except for one record which was 140 (possible outlier).

Conclusion: Data are of questionable reliability - cannot be used to set quantitative limits.

Molybdenum: RMDL = 20 μg/L

Candidate parameter for Petro-Canada Oakville and Esso Nanticoke refineries. Occurrence classifications and average effluent ratios are infrequent high (1.8) for Petro-Canada Mississauga, infrequent medium (1.5) for Petro-Canada Oakville and frequent medium (1.7) for Esso Nanticoke. The average travelling blank ratios were 0.2 for the 3 refineries, i.e. no suspect for field contamination.

Conclusion: Data are of reliable quality but low - cannot be used to set quantitative limits.

Vanadium: RMDL = 30 μg/L

"Unique parameter"- candidate parameter for Petro-Canada-Mississauga. Occurrence classification and average concentration ratio is infrequent medium (1.6). Three values in one quarter were entered as 110, 140, and 140 μg/L. One other detection occurred at the RMDL. All other values were less than the RMDL and not detected. Once the average travelling blank ratio is subtracted from the effluent data ratio, the value only drops to 1.4 (no indication of field contamination).

Although not selected for Esso-Sarnia, vanadium was classified as infrequent low at average concentration ratio of 0.9 (less than RMDL). All other refineries are classified as non-occurrence.

Conclusion: Data's reliability cannot be verified. Data cannot be used to set quantitative limits.

ATG 10

Selenium: ***RMDL = 5 μg/L***

Candidate parameter for Esso-Sarnia, Petro-Canada-Oakville, and Esso-Nanticoke. Occurrence classifications and average effluent ratios for Esso-Sarnia, Petro-Canada-Oakville, and Esso-Nanticoke were frequent medium (3.2), infrequent medium (1.1), and frequent low (1.1) respectively. After subtracting the travelling blank average ratios from the above ratios, the values were 2.8, 0.9, and 0.9 respectively. No irregularities are evident in the effluent data and QA/QC data.

Conclusion: Data are of reliable quality - can be used to set quantitative limits but with caution (data low).

ATG 11

Chromium (hexavalent): ***RMDL = 10 μg/L***

"Unique parameter" - candidate parameter for Esso-Nanticoke (only monitored by Esso-Nanticoke). It was found that the average effluent ratio was 1.3 and it was classified as a frequent low. Once the average travelling blank ratio was subtracted from the average effluent ratio, the ratio dropped to 1.0. Hexavalent chromium is perishable and the analysis must be done quickly. Total chromium was not detected which makes this finding of hexavalent chromium questionable.

Conclusion: Data are of unreliable quality - cannot be used to set quantitative limits.

ATG 12

Mercury: ***RMDL = 0.1 μg/L***

Candidate parameter for Petro-Canada-Mississauga and Esso-Nanticoke. Occurrence classification for Petro-Canada Mississauga was infrequent low and average concentration ratio was 1.1. For Esso-Nanticoke, the average effluent ratio was 0.8 and it was classified as a frequent low. After subtracting the average travelling blank ratios from the effluent data, the ratios became 0.1 and 0.2 for Petro-Canada Mississauga and Esso Nanticoke respectively (possible field contamination). For Petro-Canada Mississauga 75% of data were reported as <DL. For Esso Nanticoke 50% of data were reported as <DL. The rest of data were either 0.10 (RMDL) or 0.15.

Conclusion: Data are of unreliable quality - cannot be used to set quantitative limits (data too low).

ATG 16

1,2-Dichloroethane: RMDL = 0.8 μg/L

Candidate parameter for both Petro-Canada refineries and Esso-Nanticoke. Occurrence classification was frequent low for all three refineries and the average effluent concentration ratios ranged from 0.8 to 1.8. All other refineries were classified as non-occurrence. After subtracting the average travelling blank from the average effluent ratio, the ratios were negative for both Petro-Canada refineries and 0 for Esso-Nanticoke (strong possibility of field contamination). The recoveries were all within 60 - 140% except for Nanticoke (51%). Oakville refinery's average difference ratio between the duplicate and the effluent data was greater than 1 (i.e. greater than RMDL). The two Petro-Canada refineries used the same laboratory and reported method detection limit higher than the RMDL (0.8). Therefore, when the result such as 2.10 '<DL' was reported, the parameter was selected although it was not actually detected. Esso - Nanticoke also had 6 records in which the MDL was out of compliance with the RMDL (0.8). There were no actual detections in the blanks either.

Conclusion: Data cannot be used to set limits, since there were no actual detections.

1,2-Dichloropropane: RMDL = 0.90 μg/L

"Unique parameter", Candidate parameter for Petro-Canada-Oakville. Occurrence classification was frequent low for Oakville refinery with the average concentration ratio of 1.6. After subtracting the average travelling blank ratio from the effluent data, the ratio becomes 1.0. The detections happened only in the first two quarters.

Although not a candidate parameter for Shell, it was classified as infrequent medium with the average concentration ratio of 3.3. The high average effluent ratio for Shell is attributed to one record of 27 μg/L (outlier). All other values are '<DL' or at RMDL.

All recoveries of travelling spiked blanks are good.

Conclusion: Reliability of data can not be confirmed. Data cannot be used to set quantitative limits.

Bromomethane: ***RMDL = 3.70 μg/L***

"Unique parameter", candidate parameter for Petro-Canada Oakville refinery. Occurrence classification was frequent low and the average concentration ratio was 2.0. After subtracting the average travelling blank the ratio became 0.9 for Oakville refinery. Oakville refinery had 6 records listed as 4.3 '<DL'(i.e. >RMDL), 3 records of 17.9, 19.8, and 17.2 μg/L (all in the same quarter), and the rest were 3.70 '<DL'. Practically, bromomethane was detected only in one quarter.

Although not a candidate parameter for Petro-Canada Mississauga refinery, bromomethane was classified as infrequent medium with an average concentration ratio of 1.6. After subtracting the average travelling blank the ratio became 0.6 for Mississauga refinery. Three out of 12 records were reported 13.0 '<DL' (i.e. >RMDL) and all the other records were all 3.70 '<DL'. There was no actual detection.
All other refineries were classified as non-occurrence. There were no problems with duplicate samples or with recoveries of the travelling spiked blanks.

Conclusion: Data reliability cannot be confirmed. Data cannot be used to set limits.

Chloroform: ***RMDL = 0.70 μg/L***

Candidate parameter for Petro-Canada-Mississauga, Novacor, Suncor, and Esso-Nanticoke. Occurrence classifications and average effluent ratios for these four sites were frequent low (4.0), frequent low (1.1), infrequent high (1.1), and frequent low (2.1) respectively. The other 3 refineries were all classified as non-occurrences. After subtracting the average travelling blank ratios from the effluent data for the four selected sites, chloroform only shows up significantly in Mississauga refinery (average ratio = 2.2 whereas it is less than 1 for all the other 3 selected sites). Mississauga refinery also showed a problem with their duplicates. The average difference between the duplicate and effluent data was 1.5 times the RMDL (at Petro-Canada-Mississauga and Esso-Nanticoke). Attributing to Mississauga's large average effluent ratio is one record listed as 14.6 μg/L (possible outlier).

Conclusion: Data are of unreliable quality. Data cannot be used to set quantitative limits.

Chloromethane: RMDL = 0.70 µg/L

"Unique parameter", candidate parameter for Petro-Canada-Oakville. Occurrence classification was frequent low and the average effluent concentration ratio was 1.8. Although not a candidate parameter for other refineries, it was classified as infrequent low (1.1) for Petro-Canada Mississauga and infrequent low (0.6) for Esso-Nanticoke. After subtracting the average travelling blank ratio from the average effluent ratio, the ratios drop to 0.9 for Oakville refinery, 0.2 for Mississauga refinery and -0.7 for Esso-Nanticoke. All other refineries were classified as non-occurrences.
Oakville refinery had 6 records listed greater than RMDL, ranging from 6-13.8 µg/L. Mississauga refinery had 3 values listed as 5.2 '<DL' (non-detect) in the first quarter, and all the other records were non-detects. Esso-Nanticoke had 3 records above RMDL in the last quarter, and all other records were <DL.
The average recoveries of the travelling spiked blank are identical for the 2 Petro-Canada refineries (73%), since they used the same laboratory. Novacor and Shell used the same laboratory and had identical average recovery (108%). The average recovery is 336% for Esso-Nanticoke (false positive).

Conclusion: Data reliability cannot be confirmed. Data cannot be used to set quantitative limits.

Methylene Chloride: RMDL = 1.3 µg/L

"Unique parameter", candidate parameter for Esso-Nanticoke. Occurrence classification was frequent medium, with an average effluent ratio of 4.6. After subtracting average travelling blank from the effluent data, the ratio became 1.1. Average recovery for travelling spiked blank is 191% (false positive).
Although Methylene chloride was not selected as a candidate parameters for other refineries, it was classified as infrequent low for both Esso-Sarnia and Novacor with the average effluent concentration ratio of 0.6 for both refineries. For all other refineries it was classified as non-occurrence. After subtracting the average travelling blanks from the effluent data, the ratios became 0.0 for Esso Sarnia and -1.1 for Novacor (possible field contamination). Average recoveries for travelling spiked blanks were 109% for Esso Sarnia and 86% for Novacor.
Methylene chloride is a known laboratory contaminant.

Conclusion: Data are of unreliable quality . Data cannot be used to set quantitative limits.

ATG 17

BTX compounds (Benzene, Toluene, m- & p-Xylene, o-Xylene

Benzene: ***RMDL = 0.5 μg/L***

"Unique parameter", candidate parameter for Esso-Sarnia. It was classified as a frequent low with an average effluent ratio of 3.7. After subtracting the average travelling blank, the ratio dropped to 2.4. The average recovery of the travelling spiked blanks is 102%. The absolute difference ratio of duplicates is 1.1.

Although not a candidate parameter for other refineries, it was classified as following for the other refineries:

Refinery	Class	Av.Conc.	Minus Travelling Blank Ratio	Recovery %	Duplicate Difference
PC-Mis.	IL	0.3	0.0	96	0.1
PC-Oak.	IH	1.8	1.6	99	0.0
Novacor	IL	0.5	0.0	97	0.0
Shell	IH	1.0	-0.1	54	1.4
Suncor	IH	1.0	0.3	99	0.4
Esso-N.	IM	0.5	-0.2	80	0.5

From the above data one can conclude that benzene was positively detected (at low levels) at Esso Sarnia only. The examination of travelling blanks shows a chance of field contamination at Esso Sarnia and Suncor. Recoveries of travelling spiked samples are good. There are slight problems with duplicates in Esso-Sarnia and Shell (average differences between duplicate samples and effluent data are 1.1 and 1.4 respectively).
The corrections for method blank were within good laboratory practices, except for Suncor were the method blank concentration ratio was 4.7 (strong possibility of laboratory contamination). Method blank results for the two Esso refineries were not available.

Conclusion: Data are low and of unreliable quality due to a possible field and laboratory contamination. Data cannot be used to set quantitative limits.

Toluene: RMDL = 0.50 μg/L

Candidate parameter for Esso-Sarnia and Shell. Occurrence classification and average effluent ratio are frequent low (3.8) for Esso-Sarnia and infrequent high (2.3) for Shell. After subtracting the average travelling blank ratio from the effluent data, the ratios dropped to 2.1 for Esso-Sarnia and 0.7 for Shell (possible field contamination). The recoveries of the travelling spiked blank are good. Esso-Sarnia had a problem with duplicate samples (average difference between duplicate ratios and effluent ratios are 1.4).

Although toluene was not selected as a candidate parameter for Suncor, it was classified as infrequent high with an average effluent ratio of 1.0 (RMDL). Similarly to benzene results, the corrections for method blank were high (average of 4.7).

Conclusion: Data are low and of unreliable quality due to a possible field and laboratory contamination. Data cannot be used to set quantitative limits.

m- & p-Xylene: RMDL = 1.10 μg/L

"Unique parameter", candidate parameter for Esso-Sarnia, classified as infrequent medium, with an average effluent concentration ratio of 2.2. After subtracting the average travelling blank ratio from the average effluent data, the ratio became -0.4. This high travelling blank ratio suggests possible field contamination.
Although not a candidate parameter for other refineries, m- & p- Xylene was classified as infrequent (L,M, and H), with the concentration ratios ranging from 0.2 (Nanticoke refinery IL) to 1.2 (Shell IM).
Method blank results were investigated and corrections were normal for all the refineries except Suncor (average method blank ratio 4.7). Method blank data were not available for two Esso refineries.
Recoveries of travelling spiked blanks are good.
High values of average differences between duplicates and effluent data occurred for both Esso-Sarnia (1.5) and Shell (2.0) - high variability in reproducing the results.

Conclusion: Data are low and of unreliable quality due to a possible field and laboratory contamination. Data cannot be used to set quantitative limits.

o-Xylene: RMDL = 0.5 µg/L

Candidate parameter for Esso-Sarnia and Petro-Canada-Oakville. The classification and average effluent ratio for Esso-Sarnia and Oakville refinery was frequent low (3.3) and infrequent high (8.2) respectively. After subtracting the average travelling blank ratios from the effluent data for the 2 selected sites, the ratios become 0.3 for Esso-Sarnia and 8.0 for the Oakville refinery. This suggests possible field contamination for Esso-Sarnia.

Effluent ratios for other refineries ranged from 0.3 - 1.2.
All recoveries are good.

Duplicates only seem to be a problem with Suncor (average difference between duplicate ratio and effluent data ratio is 1.7).

Investigation of method blanks shows good laboratory practices, except in case of Suncor were corrections were high (average method blank conc ratio of 3.7), indicating possible laboratory contamination. Method blank results were not available for the two Esso refineries.

Conclusion: Data are low and of unreliable quality due to a possible field and laboratory contamination. Data cannot be used to set quantitative limits.

ATG 19

Naphthalene: RMDL = 1.6 µg/L

Candidate parameter for Esso-Sarnia, Suncor, and the two Petro-Canada refineries, classified as frequent low with the average concentration ratios of 1.2 and 0.7. Esso-Sarnia and Suncor share the same contract laboratory, and the two Petro-Canada refineries also share the same contract laboratory. The Oakville refinery had only one actual detection, all of the other values for the selected sites were all non-detections. Both contract laboratories did not always achieve detection limit equal to RMDL. All of the travelling blanks were non-detects also.
Naphthalene was selected as candidate parameter although it was not actually detected because the laboratory detection limit was grater than the RMDL.

Conclusion: The data obtained cannot be used to set quantitative limits, since there were no actual detections.

Pyrene: *RMDL = 0.40 µg/L*

Candidate parameter for Esso-Sarnia and Suncor, classified as frequent low with the average concentration ratio of 1.2. Both refineries share the same contract laboratory. All values are listed as 0.50 '<DL' for both refineries. All the travelling blanks are listed as 0.50 '<DL'also. All of the recoveries from the travelling spiked blanks are good.
Pyrene was selected as candidate parameter although it was not actually detected because the laboratory detection limit was grater than the RMDL.

Conclusion: The data obtained cannot be used to set quantitative limits, since there were no actual detections.

ATG 20

2,3,4,5-Tetrachlorophenol: *RMDL = 0.40 µg/L*

Candidate parameter for Esso-Sarnia and Suncor, classified as frequently low with the average concentration ratio of 1.2. Both refineries share the same contract laboratory. All values were listed as 0.50 '<DL' for both refineries. Also, all the travelling blanks are listed as 0.50 '<DL'. All of the recoveries from the travelling spiked blanks are good, except Esso-Nanticoke's recovery which seems to be low (41%).
2,3,4,5,-Tetrachlorophenol was selected as candidate parameter although it was not actually detected, but because the laboratory detection limit was grater than the RMDL.

Conclusion: The data obtained cannot be used to set quantitative limits, since there were no actual detections.

2,3,4-Trichlorophenol: *RMDL = 0.60 µg/L*

Candidate parameter for Esso-Sarnia and Suncor, classified as frequent low with the average concentration ratio of 1.3. Both refineries share the same contract laboratory. All values were listed as 0.80 '<DL' for both refineries. Also, all the travelling blanks are listed as 0.80 '<DL'. All of the recoveries from the travelling spiked blanks are good.

2,3,4-Trichlorophenol was selected as candidate parameter (although it was not actually detected) because the laboratory detection limit was grater than the RMDL.

Conclusion: The data obtained cannot be used to set quantitative limits, since there were no actual detections.

Pentachlorophenol: RMDL = 1.30 μg/L

Candidate parameter for both Petro-Canada refineries, classified as frequent low with the average concentration ratio of 1.1. Both refineries share the same contract laboratory. Both refineries had 6 values of 1.50 '<DL', and all the other values were 1.30 '<DL'. All other refineries were classified as non-occurrences. Thus, there were no actual detections for the entire sector. All of the travelling blanks for all refineries were "non-detects". Recoveries for the travelling spiked blanks are good for all refineries.
Pentachlorophenol was selected as candidate parameter (although it was not actually detected) because the laboratory detection limit was grater than the RMDL some time during monitoring.

Conclusion: The data obtained cannot be used to set quantitative limits, since there were no actual detections.

1,2,3-Trichlorobenzene: RMDL = .010 μg/L

Candidate parameter for Novacor and Shell, classified as frequent low with an average concentration ratio of 1.5. Both refineries share the same contract laboratory. All values were listed as 0.015 '<DL' for both refineries. All other refineries are classified as non-occurrences.
There were no travelling spiked blank data nor travelling blank data to analyze.
1,2,3-Trichlorobenzene was selected as candidate parameter (although it was not actually detected) because the laboratory detection limit appeared to be grater than the RMDL. Upon request, the contract laboratory has informed Novacor that the method detection level of 0.0148 μg/L, which was previously reported, has been recalculated to be 0.0086 μg/L. A further set of 8 low level replicate samples was used to determine the detection level of 0.0086 μg/L.
Thus, it can be concluded that 1,2,3-trichlorobenzene was never detected at or above RMDL for Novacor and Shell.

Conclusion: The data obtained cannot be used to set quantitative limits, since there were no actual detections.

ATG 24

Dioxins and Furans:

All of the parameters in this analytical group were selected due to the fact that the laboratory MDL was greater than the RMDL. None of these parameters was actually detected.

Conclusion: The data obtained cannot be used to set quantitative limits, since there were no actual detections.